trends

in education

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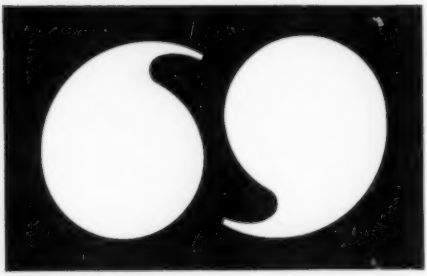

Talking Points

I have been waiting here since ten minutes. When do I become a sausage?

Professor Lancelot Hogben once in an idle moment invented a language. I mean 'in an idle moment' quite literally because he was in hospital at the time and had, it seems, when he was not under the knife, nothing better to do. He gave his language a name – Interglossa – a grammar, a syntax, and even a rudimentary literature. Having set the ball rolling – though it did not roll very far as it happened – he turned his mind to other, more pressing matters.

Perhaps critics of language teaching and learning in British schools would merely regard this as evidence that we cannot master existing languages adequately and thus occasionally we have to manufacture our own.

Why can't these damned foreigners speak English? used to be our imperial and imperious cry. Now, of course, the embarrassing thing is that these damned foreigners do – and all too fluently in many cases.

There is on the face of it, of course, no logical reason why the British should be any less capable of learning a foreign language than any other nation. Our trouble is lack of motivation. English is a world language and perhaps we are unconsciously influenced by that fact so that we can no more shake off our imperial legacy than a Scot can shake off Calvinism.

Oddly enough, although for complex reasons the story of modern language teaching in secondary schools is not an entirely happy one, language classes in adult education are booming. The package holiday may in a literal sense be doing more for international understanding than we realize.

Which reminds me . . .

Some time ago a French tourist visiting London called in at a *bureau de change*. There were no other customers just at that moment and the whole place seemed deserted. He waited a short while but no assistant appeared so he rapped on the counter with a coin. Still no assistant. Just then his eye alighted on a sign that read: 'Ici on parle français'. Rapping the counter again, he called out: 'Qui parle français ici?', and a voice from an inner office replied 'Je!'.

There may be a lesson here for us all. If you are going to be wrong, do it with confidence.

Computers in education

Five articles in this issue of Trends *deal with various uses of the computer in schools and in other branches of education. They represent a very small sample of the wide-ranging activity that has been developing and expanding throughout the '70s in this field. Many of the uses of the computer discussed in these articles are still comparatively rare and represent only a small part of computer usage in education. In higher and further education, in addition to courses in computer science, the bulk of the use lies with the servicing role that the computer can provide in many subject departments.*

Of the developments in the schools some are of note because they are improving the management and administration of education, others because they are serving different subject areas in the curriculum and introducing the students to new techniques they may meet later in higher and further education and in the world at large.

Of course, no one would claim that all the innovation and experiment of the past few years could be described as successful or desirable. Several authors in this issue hint at their own misgivings about some of the work they have seen or have been involved with. There is general agreement that the majority of pupils in secondary schools will benefit from learning about, and using, computers at some stage in their education, not exclusively through the mathematics course, but also within other subjects where its use is appropriate. There seems to be much less agreement – and therefore a need for further debate – about developing computer studies as a subject in its own right.

The changes in electronic technology in the last few years have been quite dramatic, resulting in computers that are small and (relatively) cheap. These trends are expected to continue. They imply that within the next few years, microcomputers in educational institutions will be almost as common as typewriters. In developments of this kind there are pitfalls to be avoided as well as advantages to be gained. However low the cost, resources in education are too scarce to be wasted on inappropriate

equipment or on units that are incompatible with other items or incapable of expansion as use grows. Curricular and administrative innovations, which require the purchase and use of a microcomputer, obviously need careful planning and the commitment of many staff, together with sound advice from the expert. Since this issue of Trends *was planned, the implications for education of new and rapid developments across the whole field of micro-electronics have assumed greater significance. Much comment has recently appeared in the press and elsewhere. In response to Government interest, the issues are being carefully considered at the Department of Education and Science. Thus this special issue of* Trends *is timely; the articles are a useful reminder of the valuable experience already gained on which future developments can be built.*

As Richard Hooper explains in his article (p. 19), in July 1977 the Department of Education and Science formally asked the Council for Educational Technology to undertake responsibility for monitoring an information and programme exchange activity after the termination of the National Development Programme in Computer Assisted Learning (NDPCAL). The Council has agreed to this request, and since its interest includes applications that extend beyond those of the NDP, it will seek to encourage the use of computers as one element of the many available to staff and students in all sectors of education and training. There are details of many computer user groups on their files with which newcomers, at least, should acquaint themselves.

The Council will also do its best to extend its general information service to include the answering of enquiries relating to the educational uses of the computer, and from time to time it will sponsor, either alone or with other agencies, conferences and seminars for those with specific interests in this field.

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An ABC of computing

P. R. Smith
HM Inspector, Metropolitan and South Midland Division, with responsibility for computer education

It is not yet thirty years since the first computer was built for commercial use in Great Britain, and since then the making of computers has become an important British industry with a worldwide market. This rapid expansion has been accompanied by an ever-increasing demand for computer education to which the higher and further education institutions have readily responded. It can be fairly claimed that, although constrained by limited finance, they have kept abreast of technological developments in the industry and have provided computer education of a standard not to be found elsewhere in Europe.

Before considering how this success has been achieved and what resources are needed for the teaching of the subject, it is necessary to understand something of the current methods used to operate a computer.

Before a computer can perform a calculation or a similar logical operation it must be given a set of instructions and the data it is to use in obeying them. The set of instructions is called a 'program'. (Note the spelling of program, approved by the British Standards Institute in 1962.) The program and data are written in a code known as a 'programming language' which the computer can be made to read in one of two ways. They may be translated into a series of holes punched in cards (or sometimes paper tape) which are then passed through an electronic reader, or they may be typed directly into the computer by means of a teletype (teletypewriter) connected to it. In both cases electric impulses are generated, which cause the computer to process the data in accordance with the instructions given in the program. The results are either printed on a line printer, or typed on a teletype, or displayed on a small screen similar to that of a portable television set.

A typical line printer prints lines consisting of 80–120 characters at a speed of 1,000–1,500 lines per minute on to paper fed into it from a roll about 50 cms wide. If a teletype is connected to a computer it is called a 'terminal', and if it has a screen attached to it on which the computer can display its results, it is called a 'visual display unit' (VDU).

The electronic reader, usually known as a 'card reader' or 'tape reader', is an input device; the line printer and the VDU are output devices; and the teletype can be either, according to the use to which it is put.

A 'job'

A program and its associated data are called a 'job', and it takes the form either of a stack of punched cards or of a punched paper tape. The cards relating to a large number of jobs can be gathered together and fed in one batch through the electronic reader. This procedure, known as 'batch processing', is a standard method of operation for routine calculations and for jobs that do not require an immediate result. The time that elapses between the input of the program and the output of the results is known as the 'turn-round' time and for

batch-processing work, this may be considerable. The delay is not caused by the computer – which processes the work almost instantaneously – but is inherent in the administration of the system. The response of the computer to terminal operations depends upon the total load of work being processed: it is often almost immediate and delays of more than a few minutes are unusual.

The early computers used paper tape and since they had only one channel for the input of material there was much congestion. There was some improvement when machines with card input were developed and batch processing became possible, but the problem was not satisfactorily solved until the use of terminals became widespread in the mid 1970s.

The large, modern computer operates in a time-sharing mode, i.e. it can process a number of jobs simultaneously, either from the batch-processing input or from terminals. If it can accept signals from more than one terminal at a time, it is said to possess 'multi-access facilities'.

It is sometimes necessary to provide batch-processing facilities at a centre remote from the main installation. This is done by means of a 'remote job-entry terminal', which consists of a card reader and a line printer connected to the computer by a high-quality telephone line.

Many other sophisticated devices exist whereby the results of calculations processed by computers can be displayed graphically or plotted on paper by automatic graph-plotters. These can be controlled by the operator and adjustments can be made to the displayed result by altering the data on which the program is operating.

Most common type

Computers such as those described above, which use digits to store programs and data, are known as digital computers and are by far the most common type in use today.

Another type of computer used largely in laboratory work is the 'analogue computer'. This uses properties in its design that are analogous to those of the problem with which it is associated. Thus a thermometer is an analogue computer because the height of the mercury is a measure of the surrounding temperature. In general practice, analogue computers work electronically and are often used to control equipment or to produce experimental results which are displayed graphically.

The physical parts of a computer are called 'hardware'. The instructions to the computer – i.e. the program's operating instructions, and so on, which make it obey the command of the operator are known as 'software'.

Early developments

The early computer had its own programming code, sometimes known as an 'autocode', which could not be used on any other machine. This restriction inhibited progress, and the first aim of the early software writers was to produce a language which could be universally used. The principles of programming were enunciated in 1951 and the development of general purpose languages has continued ever since. The first language to become generally available was Fortran (Formula Translation), introduced in 1951 as an advanced general-purpose language for use in commercial and scientific work. This was followed by Algol (Algorithmic Language) which was invented by an international committee in 1958: it was similar to Fortran but was more suitable for mathematical and scientific work. Two years later, a complicated language, Cobol (Common Business Oriented Language),

was introduced for use in commerce, and it is the most heavily used language today.

Within the last five years, a new general purpose language – Basic – has become very popular. This is similar to English, conversational in character, particularly useful in multi-access systems, and, most important, easy to learn. Most computer users write satisfactory programs with it, albeit of a somewhat limited nature. Many other languages have been developed for special purposes and some are in common use, but Fortran, Algol, Cobol and Basic provide the foundation for nearly all computing today.

Packages

It is not, however, necessary for all computer users to be able to write programs. Simplified procedures, known as 'packages', have been devised for those who are concerned only with obtaining results from the computer. A package consists of a set of prepared programs designed to instruct the computer to carry out certain mathematical or statistical routines. The user has merely to input the package (in the form of a stack of punched cards or a punched paper tape) and the relevant data into the computer, and is thus relieved of the chore of writing the program.

The modern computer has one feature that distinguishes it from all other automatic machines: it is able to store a program of instructions which it will obey, and will continue to obey indefinitely, until ordered to stop. The first computer of this type was built in America in 1951 for the American Bureau of the Census, and in this country J. Lyons and Co. Ltd. built a similar machine in 1953, which remained in use in their offices until 1965.

Although it was possible to buy a computer in the early 1950s, as recently as 1965 there were still only some 600 in use in Great Britain. It is remarkable that at that time there were no less than forty-one in universities and forty-seven in further education institutions. Today the computer is a commonplace tool of the trade in all manner of commercial, industrial and public enterprises. All universities and polytechnics have their own machines and there are about one hundred in other higher and further education colleges.

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Educational computing facilities in Birmingham

David Tinsley
General inspector for computer education, Birmingham LEA

Educating young people about the computer has now become a recognized and respectable part of the curriculum in many schools. This is reflected in the amount of time that is allocated to the subject in preparation for public examinations at CSE and GCE O- and A-level. But the examination-conscious schemes of the last few years have worried many advisers and teachers, who consider that the content of existing courses leaves much to be desired. These courses tend to concentrate on trival testable elements, to emphasize programming for its own sake, and to be biased towards a mathematical view of computing. All of this tends to obscure the basic concepts

of information processing and prevents the student from sensing the wider importance of the computer as a universal tool for modern man.

Mathematics teachers

In schools, where much of the early curriculum development evolved, it was the mathematics teacher who made the first move. A close affinity between basic algebraic forms and computer programming was also recognized. Although this mathematical bias still pervades many school computer studies syllabuses, the development of the cheap electronic calculator and its ready adoption by school children, if not by their teachers, had made much of this early work irrelevant.

In industry, the pressures for financial survival have meant the successful adoption of computers. Industry has therefore needed people who knew how to apply the computer to current and future problems that were very different from those found in the classroom. The majority of industrial applications require an understanding of data processing in what may be described as the automation of traditional clerical activities. In addition, the computer is also used as a production instrument – for example, as a design assistant, a machine tool operator, a stock controller, and a financial analyser.

Finally, in education, the computer is being used to improve the service – it handles financial matters, administers grant applications, analyses population trends and coordinates school supplies. In some cases, timetables are prepared by computer, and examinations are marked and pupils' records kept by automatic methods. It is therefore vital to maintain a relevant and contemporary content in computer studies courses, especially if one aim is to help the next generation of users to make the most of the opportunities the computer can provide for the advancement of society.

Developments in Birmingham

Birmingham, a city of industrialists and realists, has recognized that the study of computing is an essential component of the curriculum in its schools, and has for the past five years given practical support to its development. In 1973, a general inspector for computer education was appointed and was allocated an annual budget for the subject as a separate heading of account from mathematics.

To support an essentially practical subject, computer power has to be provided at the time when students and teachers require it most. However, this is invariably when most local computers are actively engaged in their own business and the cost of computer time from commercial bureaux is correspondingly expensive. In 1973, the City Treasurer's computer could not give priority to school work during the day or provide a fast enough turn-round of programs run by batch processing methods in the evening. The solution was to use the spare day-time capacity of the Open University student computing service and to make this available on-line to terminals in classrooms. At first, the terminals were installed on a shared basis, one per consortium of secondary schools. (The Birmingham consortia consist of groups of schools in areas of the city which work together to provide a full range of educational opportunities, irrespective of school size and location.) Within three years, however, it was possible to provide terminals in all schools where there was at least one established computer studies course on the timetable.

Computer terminals

The cost of maintaining over seventy terminals in schools is borne centrally, and teachers are encouraged to use as much time as they can organize on their single terminal. At first, connexion to the Open University in Newcastle upon Tyne was by local telephone call to a

Post Office multiplexing unit in the main city exchange. Following the major tariff revisions in 1975, however, considerable savings were made by installing a privately owned telecommunications processor and connecting this to Newcastle and to the schools by private telephone lines. In 1977, it became possible to use the city's own computer for school purposes, and a range of computing systems is now available to the teacher at the terminal. With the development of small and cheap computers based on microprocessors, we foresee that schools will continue to enjoy a range of terminal-based facilities, while acquiring their own system for classroom computing.

The network of terminals and private telephone lines has made it possible to contemplate new techniques for the processing of student programs. For example, by using mark-sensed card-readers based on an area centre, a batch of programs and data can be entered into the system at the end of the school day to be processed in the evening by the city computer. By leaving a terminal connected to the private line overnight, the results can be printed at the school in time for collection by a class before school on the following day. There is no extra telephone charge for this system because the lines are rented on an annual basis. The current cost of all the present computing facilities, including maintenance and computer time, works out at about £500 per terminal per year.

In the classroom, the aim has been to keep the system as simple as possible. No teacher is expected to have a detailed knowledge of computer technology, maintenance, operation or telecommunications systems. They and their students are expected to use the computer as a natural extension of their daily work. A typical installation provides a telephone outlet in four areas of the school chosen by the staff – for example, mathematics, science, humanities and home economics – so that terminals may be moved as required to the most appropriate site. Wherever possible, a computer room is set aside in existing schools for use by small groups and individuals. This is often an adapted stock-room or partitioned area, where the terminal equipment may be used without disturbing other classes. A terminal room is included in all new building plans, preferably near to the main library and resources area of the school.

Where necessary, schools can borrow extra terminal equipment for demonstration purposes, the most popular of which is a device that enables a large screen television set to be used as a display which can be seen by the whole class. Software packages, such as those developed by the Schools Council project 'Computers in the Curriculum', can be used by subject departments without the support of computer specialists. If a school uses a computer to prepare its timetable or to assist with administrative record keeping, these systems can rapidly be modified or updated by the school itself. The careers service is developing a guidance and information system that will soon be available on the network and hence at every school terminal.

In-service training

Like other local authorities, Birmingham has found it difficult to recruit teachers whose specialisms include a knowledge of computing. To support the in-service training of teachers, it was decided in 1974 to establish an educational computing centre to act as a focus for the work of local colleges and the University of Birmingham. A head-teacher was appointed as director of the centre and a team of full-time teachers of computer studies was engaged to assist with the development of the subject within the city's school consortia. Aided by his secretary, a former computer professional, the director assists all

teachers on a day-to-day basis with their routine problems – computer system faults, advice on software packages, choice of books and equipment and so on.

The team of consortium teachers holds the real key to progress in the classroom through its support for teachers who are new to the subject and who need the help of a head of department. The main aim of the consortium staff is to help a school to become independent of their services by training a teacher or team of teachers to run their own computer courses. Because of the shortage of graduate computer scientists entering the profession it will be some time, however, before all the O- and A-level work can be left to individual schools.

Each member of the consortium team has an individual skill or interest that is used to benefit the whole city. Current interests include curriculum development at CSE level, the computer-managed learning of A-level physics, microprocessors for schools, and software packages for general use and for administrative routines. The director runs courses for senior management on computer-based timetabling and has helped a number of headteachers to evolve a pupil record system for their schools.

The growth of courses

Recent economic measures have made this early growth in courses more difficult to maintain, but it is interesting to note that computing has now become a significant choice for students at the fourth year option stage. Since 1975, annual figures have been available of the number of students who are studying each subject at fourth, fifth, sixth and seventh year in every secondary school. (The system of data collection and analysis was developed by one of the consortium teachers.) The subject seems to be popular with both boys and girls: current fourth year figures show that 55 per cent of those who selected computer studies are boys and a similar division of preference is found at fifth year level. In 1976–77, a total of 1,313 (7·7 per cent) of fourth year students chose computer studies, and this choice ranked nineteenth out of thirty-eight subjects provided in all secondary schools. In 1977/78, 1,364 students, (7·7 per cent) started a computing course, making the subject again nineteenth out of a reduced range of thirty-two subjects. This indicates that computing has not suffered too greatly from the loss caused by teachers leaving and not being replaced.

Links with industry

Perhaps it is not surprising that an industrial city like Birmingham should give such strong support for the development of computer courses in schools. Its teachers have been interested in the subject for over a decade and many belong to an active branch of the Computer Education Group of the British Computer Society. The local branch of the society has joined with the group to link schools with industry through a new scheme whereby a teacher of computing in schools is put in contact with a computer professional. Through links of this kind, and through a positive move by the education computing centre to keep abreast of modern technological development, we hope that teachers can keep their curricula relevant for today and provide us with a computer-literate generation for tomorrow. We have to admit, however, that not all of our teachers wish to take advantage of the facilities and the support that have been provided. But the evidence remains that over seventy examination courses are now being run in Birmingham schools, and that over 5,000 students in full-time secondary education are somehow involved in computer studies.

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*Computer education in secondary schools in Scotland**

Walter Beveridge
HM Inspector, Scotland

In Scotland, there are basically two types of course involving computers – computer appreciation and computer programming. The first, usually for 14- or 15-year-old pupils, deals with the history of computers, what they can do (and, very important, what they cannot do), and with personnel; it also includes some programming to let the children see that they too can use a computer. This course resulted from the recommendations of the first Bellis Report† (Curriculum Paper 6) in March 1969 which was substantially endorsed in 1971 by a report‡ of the international body, Centre for Educational Research and Innovation (CERI). Computer programming courses are part of the Certificate of Sixth Year Studies Mathematics, and O-grade syllabus B Mathematics and, as such, are examinable.

Investigation

An investigation carried out in 1972/3 showed that about 20,000 pupils were introduced to the computer through these two types of course and more than 1,000 teachers were involved. As the year group in Scotland is about 85,000, these figures show that almost a quarter of the possible population was receiving some education about computers.

One of the recommendations of the second (1972) Bellis Report§ (Curriculum Paper 11) was that the computer should be involved, in a natural way, with the many subjects to which it is relevant. Although computer applications do appear in certain syllabuses in business studies and geography, most courses do not require the use of the machine. In some cases, because of lack of facilities, the syllabus was designed to avoid the use of computers, and in others its value to the subject has only become apparent since the syllabus was written. Each subject, including both school and post-school elements, should be taken as a whole and an assessment made of what should be done at the various stages within the secondary school. This may happen in

* The views expressed in this article are the author's own and are not necessarily those of the Scottish Education Department.

† *Computers and the Schools.* Curriculum Paper No. 6. An interim report prepared by the Consultative Committee on the Curriculum under the chairmanship of B. T. Bellis. Scottish Education Department, 1969.

‡ *Centre for Educational Research and Innovation (CERI) Seminar on Computer Sciences in Secondary Education.* Arranged by the Organization for Economic Cooperation and Development (OECD) in collaboration with the Direction de la Coopération of the French Ministry of Education at the Centre International d'Études Pédagogiques, Sèvres, March 1970. CERI, 1971.

§ *Computers and the Schools.* Curriculum Paper 11. Final report of the Consultative Committee on the Curriculum under the chairmanship of B. T. Bellis. Scottish Education Department, 1972.

Scotland over the next few years as the Munn and Dunning Reports, which are currently being considered by The Secretary of State, involve extensive reconsideration of syllabuses.

Teacher training is one of the main problems. All secondary teachers in Scotland attend a pre-service training course at one of the colleges of education, where considerable emphasis is given to computer studies in the courses offered to teachers of mathematics, modern studies, business studies and science. At the CERI international conference on computers in December 1973 it was recommended that teachers already in service should be voluntarily seconded to an appropriate centre, on a full-time basis, for a course lasting about twelve weeks, to gain experience in computing and to investigate the relevance of the computer in their own subjects.

In this way, it was hoped that the subject specialists would be able to make an informed judgement on the value of the computer and, where appropriate, integrate computer applications into their own work. However, apart from a few exceptional cases, it has not been possible to implement this recommendation in Scotland so far, and so the establishment of a pool of teachers well-versed in computing and computer applications is a major problem still to be solved.

The future

There are basically two forms of computer usage in education, 'batch processing' and 'on-line'. In the batch-processing environment, programs are written by hand, sent to a centre to be punched on to cards or tapes, run through the computer and returned. In on-line work, the user sits at a terminal with a keyboard like that on a typewriter and interacts directly with the computer, which may either be close by or connected to the terminal via a telephone line. With the advent of the microcomputer, the day is not far off when most schools will have a small computer system for use in teaching and administration. Educational uses will cover programming and appreciation courses, simulation, analysis of experimental results and generation of data, while administrative applications will include pupil records, mark scaling, report cards, item banking, option blocking and aspects of timetabling.

Application packages

Many teaching and administrative packages have been written, and some of the latter are well documented in a report entitled 'Computers in School Administration.' (Copies can be obtained from the Scottish Centre for Studies in School Administration, Moray House College of Education, Holyrood Road, Edinburgh.)

Educational computer packages generally require no computer knowledge on the part of the user. For example, the 'farm game' is a package simulating the running of a 100-acre farm that produces cattle and sheep for market. The pupil is invited to plan the use of the fields giving some to cows, some to sheep and some to food crops for the animals. If there are too many acres devoted to cattle and sheep, food is automatically bought at fairly expensive rates. If too much food is grown, it is sold, but is subject to handling and other expenses. The yields of the crops and the survival rates of the animals vary from year to year and simple annual balance sheets are produced showing how well the pupil is managing the farm. To use the game, the pupil sits at a terminal connected directly to the computer which leads him through the game by asking questions like 'How many cows on farm?' and 'How many sheep on farm?'. When the whole farm is specified, the computer goes on to the end of one financial year, states how good or bad the crop and animal yields were, and gives the simple balance

```
SELECT STOCK AND CROP AMOUNTS

HOW MANY COWS ON FARM?
? 40
HOW MANY SHEEP ON FARM?
? 20
HOW MANY ACRES OF OATS ON FARM?
? 10
HOW MANY ACRES OF TURNIPS ON FARM?
? 10


CATTLE     YIELD FOR THIS YEAR IS FAIR
SHEEP      YIELD FOR THIS YEAR IS VERYGOOD
OATS       YIELD FOR THIS YEAR IS GOOD
TURNIPS    YIELD FOR THIS YEAR IS VERYGOOD
BARLEY     YIELD FOR THIS YEAR IS POOR


NO OF CATTLE ORIGINALLY      40

NO OF CATTLE SURVIVING       36

NO OF SHEEP  ORIGINALLY      20

NO OF SHEEP  SURVIVING       19


USE OF      ACTUAL    EFFECTIVE    REQUIRED    ACRES     PROFIT
 LAND       ACRES       ACRES       ACRES      SOLD

CATTLE      66.6667                                      1620.00

SHEEP        5.00                                        123.50

TURNIPS     10.0         9.6         1.1        8.5      101.9

OATS        10.0         9.5         8.0        1.6       15.7

BARLEY       8.3         7.2         8.1        -.9      -21.4

NET PROFIT IS                                            1839.6

THIS IS FARM DESIGN NUMBER      3
```

Figure 1
Farm economics

sheet showing net profit or loss. An output from such a run is shown in Figure 1.

Often participants try to maximize the profit, but they usually then see that it would be more sensible to balance the stock of the farm, so that bad years for certain items do not inevitably lead to bankruptcy.

Geography

Geography is becoming increasingly quantitative and, as this trend continues, so computer applications will become more relevant. Choropleth and isopleth maps showing, for example, birth rates, crop yields or industrial development are often drawn at the end of a piece of work as a showpiece. They involve considerable labour and frequently, once drawn, show that it would have been better to map some slightly different data. Rather than the total value of crops per hectare in a particular project, it might be better to map total value of crops per agricultural employee or grain crops per head of population. However, in the past, the work involved in recalculation and redrawing often inhibited further investigation. Nowadays, the computer can be used to produce maps quickly and easily and this is changing the role of the map from being a 'final showpiece' to an interactive situation in which one map helps to point to the next set of variables to be investigated and mapped. A suite of maps, such as the one shown in Figure 2, can be drawn quickly and easily by computer. Using the outline for Scotland as an example, we may want to make a series of maps representing patterns of unemployment, county by county, for different groups – boys, girls, people under 21 and people over 21 – and even a slow computer will only take about one minute for each of these.

Given, say, thirty spot heights in a region, the drawing of a contour map is always laborious. In this case, the preparation of the data for the computer is quick, and the machine will then produce a contour map with any required number of levels of shading. It can also magnify the map or do other helpful tricks such as produce a series of sections that fit together to form a three-dimensional model of the region. This allows a group of pupils to make models of local areas for the classroom while engaged in lessons on contours.

Situations such as the interaction between communities or the running of a transport system can be simulated by computer in the same way that farm economics were represented in Figure 1.

Language

Computers are employed to break foreign countries' codes using a method based on the fact that, in any language, certain words and letters appear with known frequencies. It is also true that any writer uses certain words like 'and' or 'but' a fairly constant number of times per thousand words and that this number varies from writer to writer. The computer can analyse passages for word repetitions, sentence length and word length, and a package is available that allows pupils to compare an anonymous text with works by known authors to see if the unknown passage could be attributed to any of them. This method was employed in the investigations of the authenticity of the Pauline Epistles.

Computers can produce poems. A program has been written by which a user lists the nouns, adjectives and verbs which the computer may use and it then produces six versions of a Japanese 'haiku', a verse of seventeen syllables, some examples of which are shown in Figure 3. The subject is 'the industrial landscape'.

It has been claimed by teachers of English that children are well motivated by this exercise and go to considerable trouble in making up the word lists. They are also quite keen to study 'their' poems and to select the best, although they might not have the interest to do this with a selection from a standard text.

Science

The computer has already been shown simulating the management of a farm but it can be used to simulate other situations too – for example, a science experiment. This can be very useful when the real experiment

Figure 2
A computer map of Scotland showing population density by counties

DIRTY BRICK
TENEMENTS
OOZING
OVER
GREEN FIELDS
CHILDREN
PLODDING
HOME

DEPRESSING
NARROW STREETS
STRAGGLING
ACROSS
HILLS
PEOPLE
SCURRYING
HOME

GRIMY
SLAG HEAPS
SPRAWLING
ACROSS
PASTURES
CHILDREN
WANDERING
HOMEWARD

DIRTY BRICK
FACTORIES
STRAGGLING
ALONG
HILLS
PENSIONERS
WALKING
HOME

GREY
TENEMENTS
CREEPING
ACROSS
GREEN HILLSIDES
PENSIONERS
PLODDING
HOME

SMOKY
OFFICE BLOCKS
SPRAWLING
TOWARDS
PASTURES
WORKERS
SCURRYING
HOME

Figure 3
Computer-produced poetry

is too difficult (measuring gravitational attraction); too dangerous (measuring the speed of a chemical reaction with increasing temperature when the reaction may become explosive); or too lengthy (Mendel's laws of heredity or a predator-prey relationship).

Taking the interaction of foxes and rabbits as an example, the computer would ask the pupil at the terminal to specify the initial numbers of foxes and rabbits. If there are many rabbits, the foxes have a fairly easy life and their numbers increase, but as this happens they eat more and so the rabbit population declines, causing hardship for the foxes and a subsequent decline in their population. With the drop in the number of foxes, the rabbit population builds up again and the process is repeated. As in the farm game, the computer, after being given the initial numbers, would proceed to show how the population will vary through several seasons.

Other examples of science applications for which packages are already in existence cover such topics as resistance-network calculations, alpha-particle scattering, projectile paths and pollution.

Some experiments involve heavy repetitive calculations. An electronic calculator is valuable in this case but it is often very simple to

feed the data to a computer and let it do the work. The pupils must certainly know how to do the calculations – this they demonstrate by writing the programs – but why should they do unnecessary routine work?

Modern studies

Information storage and retrieval is an extremely important use of the computer in insurance, banking, income tax, criminal detection and airline-seat reservation. Ideally, the information is assessed through a terminal connected directly to the computer. Considering the abstracts in a library as an example, the individual papers may be numbered and labelled according to keywords so that an article (Number 10917), dealing with the use of ARBA cement in multi-storey developments, might have the keywords: ARBA CEMENT MULTI-STOREY COSTS DATES. All the details of this, and every other abstract are stored in a computer, and if someone is interested in cement costs he could type the words: CEMENT COSTS and all the documents dealing with cement and costs would be indicated to him by the computer, including number 10917. Such a package gives pupils an insight into the working of many modern businesses.

Business studies

In one business game, participants can be organized into three companies, each manufacturing and selling the same type of item. They have a certain amount of capital and have to choose for the next three-month period, the rate of production, the investment in new plant, the advertising commitment and the transport costs. The computer processes all the information and produces detailed balance sheets for each company. The game is usually run over eight or ten periods, and wage disputes, strikes and slumps can be built in.

Or there is the 'stocks and shares game' – using current prices, participants 'buy' stocks and tailor their investments over a suitable period of time. The computer does the buying, selling and charging and produces the balance sheets.

Demonstration packages have been written for accounting situations, payroll work and electricity billing, and show how manual systems have been replaced in large organizations by a computer system.

Engineering

The examples quoted below are mainly from the field of higher education but can be discussed with pupils in school as a part of engineering courses or within modern studies.

Machines used to make certain metal components can be controlled by hand or by a punched paper tape which contains a set of instructions to take the machine step by step through the process, no matter how elaborate. The paper tape required can be produced by a computer if it is given the details of the machine and the required component. This method is error free and from about ten to twenty times faster than the manual method.

If the plans of a building, car or road are given to a computer, it can present a three-dimensional view of the item on a visual display unit (Figure 4) and rotate it so that it can be viewed from every aspect. Alterations to the plans can be fed in and the results observed. In one system of road design, while the plans are still on the drawing board, the computer can 'drive' along the road giving views of the carriageway and surroundings.

The customer's requirements for a car can be given to a computer. The chassis is put on to the conveyor belt at one end of the production line and the computer directs all the appropriate components, for this and every other car, along sub-conveyor belts to the assembly workers,

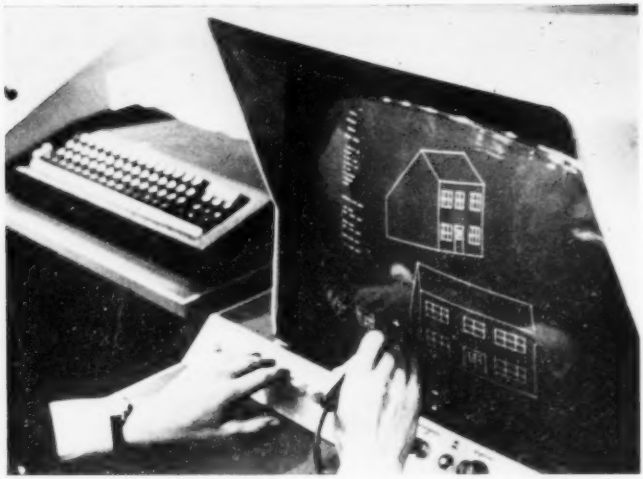


Figure 4
Visual Display Unit (VDU) in use

each part arriving just as the appropriate chassis comes along the main production line.

If an area is surveyed and the details given to a computer, it can choose the best route for the road, calculate the earth-moving to be done and the materials required, and give cost, totals and sub-totals. It does this in a few hours rather than the several months that were required using manual methods.

Access to facilities

Most schools and colleges have access to computer facilities, generally by sending programs by post or courier to a computer centre but, increasingly, through their own terminals and micro-computers. Over the next few years, there is likely to be a radical revision of school syllabuses in Scotland and it is hoped that, where appropriate, computer applications will be included.

Engineers, accountants, managers and scientists should all exploit the potential of the computer. Technical colleges, colleges of technology and universities must train their students to use computers as naturally as they use financial tables, calculators and other aids at present. This can only be done by example. The staffs of these institutions and schools must take the lead, must, where appropriate, learn the relevance of the computer to their subject, and use this approach within their courses.

Trends 1978/2

The national development programme in computer assisted learning

Richard Hooper
Former Director, National Development Programme in Computer Assisted Learning

In spring 1972, the then Secretary of State for Education and Science approved the setting up of a five-year 'national development programme in computer assisted learning' (NDPCAL) with a budget of up to £2 millions. The Programme began in January 1973 and closed down, as planned, on 31 December 1977, having cost a total of £2·6 millions. This article describes the aims and achievements of the Programme and looks ahead to the future of the computer in teaching and learning.

The National Development Programme in Computer Assisted Learning's first aim was to develop and secure the assimilation of computer assisted (CAL), and computer managed (CML) learning on a regular institutional basis at a reasonable cost. This became known as the 'institutionalization of CAL and CML'. The term CAL, as defined by the Programme, is far broader than computerized programmed learning. CAL applications are diverse, ranging from the use of the computer as a sophisticated teaching machine adapting instruction to the individual learner to the simulation of a scientific experiment that would be too costly, time-consuming, or physically dangerous in the laboratory. The term CML, however, involves the computer in four main activities: test marking/analysis; the 'routeing' of learners through an individualized course target by teachers, books, self-instructional technology; record-keeping; and report-writing.

There were two main reasons for choosing this aim. First, the growing concern on both sides of the Atlantic about the failure of innovation to endure in education institutions when external government funding ('soft' money) ceased. Second, given the real difficulties of evaluation, institutionalization was seen to be one pragmatic measure of acceptability, particularly at a time of economic constraint when more of one activity means almost certainly less of another. This first aim of institutionalization gave the Programme a firmly developmental role and this engendered some hostility in research circles.

The second aim of the Programme was to make recommendations to agencies in the public and private sector concerning possible future evels and types of investment in computer assisted and computer managed learning. This research-oriented aim was fulfilled by a study of the future of computers in education and training in the 1980s, carried out in 1976 and 1977 by the NDPCAL Directorate and project staff.

Organization and management

The Programme had some unusual features. It was steered by an executive programme committee, comprising permanent officials from

seven government departments,* chaired by a senior official of the Department of Education and Science. A large-scale independent evaluation costing £200,000 (8 per cent of the total spending) was carried out. Educational evaluation was undertaken by a team, Understanding Computer Assisted Learning (UNCAL), based at the Centre for Applied Research in Education at the University of East Anglia and led by Barry MacDonald. Financial evaluation (the cost implications of CAL) was commissioned from Peat, Marwick, Mitchell & Co., Management Consultants, and the work was carried out by John Fielden with the assistance of Philip Pearson. Neither group of evaluators participated directly in the management of the Programme, but their reports were used by the Programme Committee and the Directorate to assist their decision-making.

The central staff of the Programme Directorate, based in London, played a more active role in the formulation and management of projects than is usual for research council staff. Projects were 'step-funded' for one or two years in the first instance, with continued funding dependent on the outcome of an intensive, two-day 'midterm' evaluation. Project institutions were expected to contribute matched funding alongside NDPCAL funds – a crude, but effective, measurement of commitment. Particular emphasis was placed on the need for good project management and for projects to pay attention to the presentation and documentation of results.

The projects

Thirty-five development projects, transferability projects and feasibility studies were funded in five main areas:

— Tertiary education
— Schools
— Armed services
— Industrial training
— Transferability

Summaries of each project, and all the teaching material produced, are contained in NDPCAL's Program Index, published in 1977.

The Programme was UK-wide, with projects in Northern Ireland, Scotland, Wales and England. The largest area of project activity, as suggested in the initial guidelines given to the Programme by the sponsoring government departments, was in the numerically based disciplines in tertiary education. However, some interesting work was carried out in history and geography at secondary level.

Achievements

Evidence available at the end of the Programme suggested that in some 70 per cent of project institutions, the CAL and CML applications were likely to be successfully assimilated in 1978 and beyond. For example, early in 1977, the University of Leeds agreed to make three tenured appointments to the Computer Based Learning Project. By the end of the Programme, the University of Surrey had two computers dedicated exclusively to CAL and had agreed to fund both the educational and computing staff locally. In 1977, Hertfordshire County Council agreed to continue the computer managed mathematics project beyond the end of NDPCAL funding.

In addition, by 1977 the University of Glasgow had established a university wide CAL service using a GEC 4080 computer purchased

* Department of Education and Science, Scottish Education Department, Welsh Education Office, Ministry of Education for Northern Ireland, Department of Industry, Training Services Agency, Ministry of Defence.

out of University funds, with work in physics, maths, education, chemistry and medicine.

The Programme's success with transferability, which spreads the high development costs of CAL and CML across a greater number of users, was its other main achievement. Many projects were funded as inter-institutional cooperatives in contrast to the more traditional pattern of single-institution funding. The Computer Assisted Learning in Chemistry (CALCHEM) project, based at Leeds University and Sheffield City Polytechnic, which began in 1974 with twelve teachers in seven institutions, had by 1977 spread to ninety-one teachers in thirteen. The teaching of local history using computerized nineteenth-century census returns, an approach developed in Suffolk secondary schools by Beverley Labbett, was being adopted in some five other local authorities by 1977/78.

By 1977, the largest CML project, Computer Assisted Management of Learning (CAMOL), funded jointly by the Programme and by International Computers Ltd (ICL), involved a university (the New University of Ulster at Coleraine), two polytechnics (Brighton and Ulster College), a further education college (Bradford), secondary schools in Belfast and Birmingham, and the Royal Signals Technician Training School at Catterick Camp. The Mathematics Laboratory (MATLAB) project at Napier College of Commerce and Technology in Edinburgh transferred to Paisley College and then to secondary schools in Paisley College's 'catchment area'.

The future

Following the closure of the Programme, the Department of Education and Science is making funds available to the Council for Educational Technology (CET) over four years on a reducing basis so that it can continue the coordination of CAL and take on the aftercare of the Programme's work, which has often been neglected in past educational technology and curriculum development projects. A major feature of the CET's work will be the funding of a network of programme information exchange centres such as the Geographical Association Package Exchange (GAPE). The grant for the 1977/78 financial year totals £60,000, but the aim will be to encourage these centres to become self-financing over the four-year period.

As for the longer-term future, the NDPCAL future study concluded that whereas no revolutions should or would happen, the computer's place in teaching and learning was assured. Computing is, above all, an academically respectable technology, playing an increasing role in a widening range of disciplines from engineering to architecture and music:

> 'A steady and evolutionary growth is seen as both likely and desirable . . . Higher education is likely to retain its leadership in the development and regular use of CAL and CML over the next ten years, with further and secondary education moving more slowly. . . . A major problem associated with the growth of computer assisted and computer managed learning will, in the foreseeable future, remain cost. Whilst a dramatic decline in the hardware costs and some possible decline in telecommunications' costs are predicted, the software costs to produce good teaching materials with the computer show no signs of reduction. . . . There is a temptation to believe that the high cost of CAL and CML applications can be offset by reductions in other parts of the educational budget, for example, teachers and laboratory equipment. A decade of experience in the UK and fifteen years' experience in the USA would suggest that this is not possible, although it is possible in training. CAL and

CML are add-on costs to the budget, requiring additional staff and resources. In this respect, CAL and CML are, of course no different to language and science laboratories, audio-visual aids and educational television.'*

Trends 1978/2

Computer assisted learning

R. Lewis
Reader in computer assisted education, University of London, and Director of the Schools Council Project 'Computers in the Curriculum'

It is now nearly ten years since Chelsea College's work on mathematics for science led, through the development of mathematical models, to computers. Many people were unable or unwilling to accept that an interaction with an apparently abstract computer could help pupils to learn science. Certainly, many of the objections had to be taken seriously; they frequently arose from the belief that results from a theoretical mathematical model programmed into a computer would either be too perfect for credibility, or so rough and inaccurate as to be misleading. In either case, it was suggested that the confusion in a pupil's mind between model predictions and reality would be a disservice to science education. Some computer-based materials from abroad were also pedagogically unsound – leading pupils, for example, into activities to 'prove' a law when the law itself was built into the computer program. Some 'experiments' with computer models of blocks of glass and light rays merely replaced perfectly valid and simple laboratory work.

Having only recently come from teaching physics in school, I could easily appreciate these misgivings and, to some extent at least, allay the fears. Since that time, the many teachers working with one or other project have defined more clearly the role of the computer in assisting learning in science and in other disciplines. It has never been the intention to replace good, well-established activities with models or simulations on a computer. However, a critical examination of many curricula will reveal areas where teachers are dissatisfied with the material available for presentation, or with the limitations in the way it can be handled in the classroom or laboratory. It may be that the amount of student activity is less than desirable; perhaps the experimental work is limited because of a shortage of apparatus or its inadequacy, or the limitations of the students' manipulative skills. In fact, in examining the curriculum all that is asked is how the computer may usefully be added to existing resources. The answer may be 'not at all', or 'to supplement existing work', or 'to enable a new approach to be taken'. The result may be a unit of work involving students for a lesson, for half a week, or in a project spread over a term.

'Unit of work'

What is a 'unit of work'? Physically there are likely to be three elements: worksheets or a booklet for students; a brief guide for the

* More information on the National Programme can be obtained from the Director's Final Report, from which the above quotation is taken, published by the Council for Educational Technology (1977). The final report of the financial evaluation was published by the Council for Educational Technology in 1978.

teacher; and a computer program. The format of the student material will depend upon the topic being covered. It is likely to include an introduction to the topic – brief if the approach to the topic is a fairly conventional one, but occasionally quite extensive. This introduction may refer back to experimental work already done or suggest other work or experiments to be undertaken. The booklets or leaflets will contain questions. These are a key to the structure of the unit, prompting the student along certain lines of thought, sometimes with fairly closed problems, at other times with quite open-ended ones. Some of the problems will stimulate students to think carefully about what they already know or have just read, while others will require them to undertake an investigation using the computer model of the system under study. The investigation will involve them in activities very similar to laboratory or field work, namely, planning, execution, observation and deduction. The scope for individual initiative in at least the first two of these activities will often be greater when using computer simulations than in many real laboratory situations.

Interaction between student and computer

In general, the materials do not explicitly aim to teach anything about computer science. Neither student nor teacher is expected to know anything about computing beyond the skills involved in linking the terminal to the telephone system and in using its typewriter-like keyboard. The learner responds to questions generated by the computer program, and a dialogue is established mainly using natural language. Computer assisted learning has become much more viable since computer technology made possible this form of 'interactive

```
WHICH STAGE (1 OR 2)  ? 2

THE PROGRAM WILL CALCULATE 11 VALUES FOR ONE OF THESE
  1  TEMPERATURE (0-50 C)
  2  RELATIVE HUMIDITY (0-100 %)
  3  AIR SPEED (0-20 M/S)
  4  PORE AREA (1-200 SQ. MICROMETRES)
  5  STOMATAL FREQUENCY (1-200 PER SQ. MM)
WHICH PARAMETER IS TO VARY  ? 3
  MINIMUM AIR SPEED  ? 0
  MAXIMUM AIR SPEED  ? 20

WHAT ARE THE VALUES FOR:
  1  TEMPERATURE  ? 8
  2  HUMIDITY  ? 8
  4  PORE AREA  ? 36
  5  STOM. FREQ.  ? 50

AIR SPEED   TRANSPIRATION     RESISTANCES /(MS/CM^3)
 /(M/S)    RATE /(MICROG/H) AIR SPACE STOMATAL BOUNDARY
   0             49              11        161      364
   2            127              11        161       36
   4            135              11        161       24
   6            138              11        161       19
   8            140              11        161       16
  10            142              11        161       14
  12            143              11        161       13
  14            143              11        161       12
  16            144              11        161       11
  18            145              11        161       10
  20            145              11        161       10

CONTINUE VARYING AIR SPEED  ? NO
DIFFERENT VARYING PARAMETER  ? NO
```

Figure 1
Student-computer interaction

computing'. The example given on page 23, where the student's response is underlined, is typical.*

The student can control five factors that influence the rate of loss of water from a leaf. The computer has printed the limiting values permitted for each factor, the student has selected fixed values for four of these and has chosen to vary the air speed. The program has then calculated and printed the transpiration rates at various air speeds under these conditions. The last three columns show how other associated factors are involved, namely the 'resistance' to water loss provided by the air spaces between cells inside the leaf; the stomata themselves and the air boundary at the leaf surface.

This type of simple dialogue has been criticized because of the limited ways students can express themselves. Certainly the program structures the students' responses and does not allow free expression. However, in the majority of applications within the Schools Council projects, this structure is seen as 'guidance' and authors do not consider this pedagogically restricting. The thought processes required to make a response can often be complex, even though the response itself is a simple one. The programs are not tutorial and, in general, do not assess a student's interaction and performance any more than does a piece of laboratory apparatus.

The teachers' guides attempt to put the unit into a teaching context. The material can be used in many ways. Attempts have been made to retain flexibility so that teachers may mould the content to suit their particular treatment of the topic and match it more readily to the abilities of their students. For example, the leading questions contained in the students' material can be changed, thereby putting quite a different emphasis on the topic while retaining the program in its original form. Just as there are many experiments that can be conducted with a particular set of apparatus, so the programs can be thought of as simulating apparatus rather than as modelling specific experiments. Not unnaturally, teachers using the material are often concerned about their lack of knowledge of exactly how the program works, and so a clear statement of the basis of the model and its limitations is made in the guide. This information may also be contained in the students' material, where appropriate, to reduce the mystery of the program although it does need to be expressed carefully. The teachers who have written the material are in a good position to describe the various ways in which they themselves have organized the use of the unit, and this guidance can be most valuable to others.

Other sciences

Doubtless the above description of the approach taken in two projects aimed at secondary level† reflects the methodology of science education, but very similar styles have been used by the economists and geographers who have been involved with the Schools Council work.

To these other sciences – particularly economics – computer assisted learning has brought the possibility of exploratory learning of a kind previously available only in the natural sciences. Inasmuch as the objectives of tertiary education overlap those at secondary level, the strategies described will also apply to materials intended for college

* The example is taken from student leaflet C: 'Water loss from leaves' in the Schools Council project 'Computers in the Biology Curriculum'.

† *Computers in the Curriculum*. A Schools Council Project. The Educational Computing Section, Chelsea College, University of London, 1973–1980. *Chelsea Science Simulation Project*. A parallel project with *Computers in the Curriculum*. Edward Arnold, 1971–6.

and university students. In fact, units from the projects designed for sixth formers are being used in first-year tertiary courses.

However, computer assisted learning (CAL) in undergraduate courses may have an importance beyond that described, in providing new types of learning opportunity. Present-day undergraduates will become the professional people of the 1980s. Their education must therefore provide a sound appreciation of the role of computing, at least within their own professional sphere. The direct teaching of academic computing is, however, not necessarily the way to provide this appreciation. In association with a National Development Programme in Computer Assisted Learning project,* we at Chelsea College have used CAL not only to aid science education but also as a way of motivating students to find out about the uses of computers in their own disciplines. When working through a program, it is clear to the student that the computer is doing something impressive and useful when it is simulating a system for investigation; not only are the students motivated to question the scientific principles involved, they also wish to know about the mathematical model and the way it is handled by the program. This route into computing – using the facilities it can offer – can be followed by other applications of data reduction, experimental control, and so on.

Emphasis on student activity

In contrast to most educational technology, the emphasis in CAL is on students taking an active part rather than being passive recipients of instruction, as they so often are when subjected to television, films and other audio-visual aids. In contrast to programmed learning – with or without computers – students are not necessarily expected to work on their own. Often the interaction within a small group of students at a terminal is as important as the interaction with the computer. CAL material can also be presented via television monitors in lecture demonstration form and in this way can prompt discussion between the teacher and the whole class. Yet again, while the material has been written with an eye to its integration into a normal timetable, the notes together with access to the terminal give the student an opportunity for self-instruction outside the classroom.

Of the advantages offered by less immediate contact with the computer, perhaps the most obvious is the wider audience that can be reached. All schools can arrange to have programs processed on nearby computers (batch processing), while only a proportion – albeit a growing number – have terminals of their own small computer system.

Educational effects and future development

Finally, it is important to stress that all this work is in its infancy. We have tried quite hard not to be carried away by the technology and to avoid looking for jobs for computers. In a field where the technology is changing so rapidly, it would be foolish to orientate our ideas too closely to today's facilities. We have been primarily concerned with looking at the educational effects of what is being achieved. Are the innovations acceptable to, and do they satisfy, the needs of teachers today? The most satisfactory basis from which to work appears to be the subjective judgment of teachers. Teachers after all – particularly those experimenting with new resources – are very critical, and perhaps we should be content with their assessment. The most useful question may be 'Will you use it again?'.

The Schools Council project, which has recently gained support for

* *Computers in the Undergraduate Curriculum.* Materials available from the Educational Computing Section, Chelsea College, University of London.

a further period of development and research, will certainly be doing more of the same things that appear to have been successful during its initial lifetime. However, it will also be looking ahead to a better understanding of the role of computers in education, primarily from a pedagogic standpoint while, at the same time, keeping an eye on technological advance.

Trends 1978/2

Computer managed learning – the newly accessible educational technology

Harry McMahon
Senior lecturer in Education, New University of Ulster, and former Director of the NDPCAL Project on Computer Assisted Management of Learning in Secondary and Tertiary Education

Learning is a complex business; if it were otherwise we would not have to invest so much in trying to bring it about. Perhaps, when each of us considers his or her own learning process, then learning may seem straightforward enough, but when we, as educators, attempt to generalize about the learning processes and to facilitate the learning of others, then life becomes complicated. So how can computers help in learning and teaching, without simply adding to the complexity of an already complex process?

Computers can help in several ways to supplement and complement the skills of the teacher; just as the teacher takes on many different roles during the execution of his profession, so too can the computer.

The earliest attempts at using the computer to support learning were, on the whole, subject to a gross oversimplification of the teacher's role. The teacher was often thought of as a replaceable information-giver and as a tester of the retention of the information given. The computer assisted instruction that emerged was largely in drill and practice, the machine being used in the instructional mode to 'deliver', say, the mathematics curriculum in an expensive one-to-one interactive process between machine and student. Fortunately, this type of instructional provision has been rapidly overtaken in the United Kingdom by computer assisted learning techniques that complement the tutorial skills of the teacher. Demonstrations, simulations, calculations, experimentations, even conversations, have been added to the list of computer-based learning opportunities now available for students and teachers to use in a tutorial mode.

Role of the computer

In the instructional mode the computer dominates the learning process, in the tutorial mode it stands alongside the other learning resources, both human and technologically based, which may be called upon from time to time as learning proceeds. In the managerial mode, which we shall look at in some detail, the computer takes one further step into the background.

Increasingly, the teacher in the United Kingdom, whatever his specialism or level of operation, is being faced with demands by peers, parents and politicians to use a wider range of learning resources. At the same time, he has to engage students in a greater variety of learning experiences, treat students individually – taking more systematic account of their separate needs, interests and abilities – and report more often and more accurately on the progress of individual students.

Managerial role

Sometimes the teacher's response to these pressures has been to create a learning environment – whether school, college or university – that is rich in resources and in which student progress can be continuously monitored on an individual basis. Here new learning tasks are allocated by the teacher, in consultation with the student, on the basis of their progress. In other situations, where students are widely dispersed in 'non-viable' groups, distance-teaching systems have been established. These have similar goals but even greater problems in monitoring student progress, providing suitably selected and paced learning materials and maintaining the momentum of study. The computer comes to the aid of the teacher, in its managerial role, as he undertakes the complex organizational tasks that have to be faced when such teaching/learning systems are established. The greater the number of students, the wider the range of curriculum materials, the more intensive the progress monitoring, the more widely dispersed the students, the smaller the staff-student ratio, the more heterogeneous the student population, the greater the management problems and, correspondingly, the greater the gains to be made through computer assisted management of the learning system.

Thanks largely to the work of the National Development Programme in Computer Assisted Learning,* there is now a considerable body of experience and expertize in computer managed learning (CML) in the United Kingdom. During the five years of the national programme, established and newly developed systems have been applied to many subject areas and levels in education. Now there are some twenty applications – operational or under development – in secondary schooling, teacher education, polytechnics and universities, and in the training sector. The content areas covered include integrated science at first degree level, mathematics for craft trainees, the teaching of basic adult numeracy at a distance, curriculum design and development for trainee teachers, refresher mathematics for adult entrants to higher education, a personality theory for university students, A-level physics and programming languages for sixth-formers, and science and mathematics for the early years of secondary schooling.

These and other successful implementations of CML collectively illustrate the wide applicability of these new management techniques. It is apparent that CML need not be limited to any particular content area, nor to any particular sector of the education system. If management problems exist then CML has something to offer.

'Testing', 'routeing' and 'record-keeping'

But what does the computer actually do? The briefest and not the least important answer is that it does what it is told to do. It is surprising how many educators still imagine that computers think up for themselves what they are going to do 'to' people. So, putting the question rather more carefully, what does the teacher tell the computer to do on his behalf?

* See Hooper, Richard. *National Development programme in Computer Assisted Learning*. Final Report of the Director. Council for Educational Technology, 1977.

The management functions usually given to the computer come under three headings: 'testing', 'routeing' and 'record-keeping'. Briefly, the computer marks teacher-constructed tests when they are completed by each student at various stages in the course. On the basis of these test results, in combination with the results of work marked subjectively by the teacher, records of previous results and details of the individual student's basic skills level, interests, career intentions and any other pertinent information supplied by the teacher and student, the student is 'routed' to a new learning task, or to his teacher, or to repeat all or part of the work he has just completed. The new learning task or tasks can be any normal, or for that matter, exotic element of the teaching programme: practical work, group discussion, lecture, self-directed study, and so on. The 'routeing comment' – that is, the message printed by the computer and addressed to the individual student – may be couched in the form of a suggestion, a request or a requirement, depending on the teacher's wishes in the matter. The type of routeing comment is directly controlled by the teacher. At one extreme it could carry the teacher's invitation to the student to select from a wide range of possible alternative learning tasks or perhaps to create his own; at the other, it might represent the teacher as prescribing, for example, very specific revision and a retake of the test before compulsory attendance at a tutorial. In essence, the computer produces from a store of such comments the appropriate personalized message, written in whatever style the teacher chooses to use.

The third function of the computer is to record and, when asked, to report on what has happened during testing and routeing. Most applications of CML in the UK require the computer to report in detail to the student every time he takes a test – anything from three times a week to once in six weeks – and to report to the teacher in more general terms on the progress of all students on a daily or weekly basis.

It may be stating the obvious, but the teacher – as well as being represented in his managerial role by the computer – is still teaching, giving lectures at the blackboard, running seminars and tutorials, discussing projects, admonishing and encouraging students and continuously upstaging the computer – one hopes with consumate ease.

Range of applications

This is the general case: the particular case seems to vary within limits set only by the imagination and ingenuity of the teachers now making use of CML in the UK. The following four brief pen sketches give some idea of the range of existing applications and, perhaps, some stimulus to the imagination of any reader contemplating the use of CML.

Each year in the London Borough of Havering, several hundred pupils in third form biology classes take an individualized course in photosynthesis as part of their science curriculum. The course is a modular one, the study modules being presented in the form of worksheets which, almost without exception, involve some type of laboratory activity. On entering the laboratory, each pupil finds a computer-generated report giving the teacher's analysis of the results of his latest work in the laboratory. His scores on the worksheet questions are listed and, where he has had difficulty in responding satisfactorily to either the computer-marked or teacher-marked questions, he finds recommendations for personal revision or instructions to speak to the teacher. With this report are the three or four modules that have been

selected on the basis of his progress to date in meeting the objectives of the course, his normal rate of purposeful working and the level of inherent complexity of the new modules. At the end of the laboratory period, his answers to his worksheet questions are collected with those of other pupils. The teacher then adds, where appropriate, his own reports or marks and these, together with similar results from other schools, are sent by van courier to the LEA computer for analysis. Next morning, the van returns with reports for each pupil, a summary report on the progress of each pupil for the teacher of each class, and, vitally important, a full list of the apparatus and worksheet requirements for the next laboratory session.

Students in Northern Ireland who entered the Open University this year have, for the first time, been given the option of embarking on an informal refresher course in the basic mathematics considered necessary for successful study in the regular foundation courses in science and technology. After each two weeks of study, students working in their own homes on correspondence teaching materials have been encouraged to send the results of diagnostic tests by post to the New University of Ulster at Coleraine, where the computer analyses and reports back to individual students on their progress and to Open University staff tutors. For each item in the test the computer prints a comment selected on the basis of the student's performance on that item. It explains why a particular student response is wrong and corrects this, often with suggestions for reference back to particular sections of the correspondence materials. The computer also counts and prints scores that are based on divisions of the test into content areas and levels of cognitive skills involved. On the basis of the student's performance on individual items, on parts of the test and on the test as a whole, the computer prints a general comment which summarizes his achievement and draws attention to his strengths and weaknesses. Where student performance is less than satisfactory, he is asked to contact his tutor by telephone or letter. Meanwhile, his tutor – living anything up to a hundred miles from both the computer and his students – is alerted by post to any difficulties being experienced by his students and, in particular, to those situations requiring direct contact.

New students who enter the craft training programmes at Bradford College are known to vary widely in their basic mathematical skills. The students' competencies in this area are identified by standardized tests of mathematical ability. After a computer analysis of the test results for strengths and weaknesses, an individually tailored study programme is generated by the computer. As each student follows his own route through the materials housed in the mathematics workshop, his progress on diagnostic tests is monitored and reported to him, to his specialist mathematics tutor, who acts as the remedial expert, and to the craft teacher, who controls the learning environment in which the student is developing his craft.

After four weeks of study, involving group work, lectures and computer-marked tests and feedback, second-year trainee-teachers on a curriculum design and development course at the New University of Ulster have two options. Either they can choose to follow the theoretically biased elements of the course in independent study – making use of self-selected content modules and computer-marked diagnostic tests as and when they choose – or in guided study, where as they study they receive – via the computer – the teacher's prescriptive instructions on revision, tutorial and seminar attendance, and requirements for further study to specified deadlines. In contrast to most other CML

applications in the UK, all students in independent and guided study are alerted, in feedback from the computer, not so much to the correctness of their answer or their level of mastery of content, as to additional interpretation of complex ideas and new issues and problems associated with the value-laden concepts under study.

Getting into CML

How does one get into CML, granted that it is rather different from, say, organizing videotape recording? It is not, after all, simply a matter of buying a moderately priced set of equipment and following the instruction leaflet. Nevertheless, the NDPCAL has left a legacy of established practitioners in CML, every one of whom is experienced in, and still committed to, active support of the implementations of new CML applications.

All one needs to get started are the educational management problems, the financial resources to buy, rent or, perhaps, share one of the existing CML systems, access to a medium-sized computer for example, an ICL 1900 series machine – and the willingness to deploy existing skills or develop new ones in course-content modularization, the design of diagnostic tests and the writing of the feedback messages to be produced by the computer. One can no longer assume, without further investigation, that one has no access to an appropriate computer. The computing situation in the UK is changing rapidly. New networks are being developed. Most local education authorities, for example, now have their own machines. Many of them are prepared to see them used for CAL and CML; colleges can also get access to university machines.

Like most innovations, the most important starting conditions for success are a genuine problem, not a manufactured one, and the energy to solve it. Surprisingly, the one thing CML implementation does not need is highly developed expertise in computing. In the medium term, the existing CML systems are very probably versatile enough to accommodate most new CML applications. This accommodation calls for skills in curriculum development, test construction and classroom and course management – not in computer programming. In the jargon, the CML systems on the market are 'content-free' and 'context-free', that is they are designed to be applied to different content areas in different educational contexts according to the needs of the educator.

The Council for Educational Technology runs an information service designed to provide the link between potential CML users and established groups. As yet, no formal provision has been made in the UK for training in the development of CML systems. No doubt such provision will emerge as the demand for it appears.

The computer assisted management of learning is here to stay. Educators with management problems have ready access to educational support in this new technology, and sufficient access to computing power at the regional, if not the local, level. Indeed, the next decade could see the new generation of small computers make CML immediately accessible to most educators in the UK, and certainly to those working at secondary and tertiary levels.

Trends 1978/2

In-service and pre-service collaboration in teacher education

E. Stones
Professor of Education, University of Liverpool

This article looks at an experiment in collaboration between in-service and initial teacher training students. How does their symbiotic relationship work?

For the past five years, a course involving an interesting collaboration between in-service students and students on initial training has been running at the Liverpool University School of Education. MEd students, all with academic and professional qualifications and several years' practical experience in different fields of teaching, collaborate with post-graduate certificate of education (PGCE) students in a scrutiny of principles and practice, in which both are teachers and learners. PGCE students, each with the help and advice of an MEd mentor, plan, execute and evaluate a piece of teaching involving small groups of pupils. The MEd students, on the basis of their own studies of psychological principles, guide and counsel the PGCE students in a careful and systematic application of theory to practical teaching.

The course is one of forty options from which students taking courses choose two or four, according to whether they submit a major or a minor dissertation. Options are offered in the following fields of study: adult education, comparative education, curriculum studies, educational psychology, history of education, philosophy of education, physical education, sociology of education, special education, and teaching and classroom studies. Students taking the option described here have a particular interest in psychopedagogy – the application of theory from educational psychology to teaching – and take a linked option on the psychology of human learning. Students are not examined by traditional three-hour written examination. Assessment is by course work and dissertation, both of which frequently involve experimental and empirical work in the application of psychological theory to teaching or allied activities.

Although the relationship between the MEd student and the PGCE student may appear similar to that between a supervisor and a student in teaching practice, there are fundamental differences. The obvious one is that for the PGCE student, the MEd student is more a colleague in a joint enterprise than a supervisor. It is a cooperative relationship of student-teacher and MEd adviser, or 'counsellor'. This approach encourages the development of the concept of counselling where the teaching of theoretical principles and guidance in practical teaching fuse. The counsellor and student together explore ways of translating theory into practical teaching and how best to evaluate the success of the operation. The student-teacher is encouraged to evaluate his effectiveness by the extent of his success in getting children to learn, and the counsellor evaluates his success by the extent to which the

student has demonstrated his grasp of theory through its practical application. Thus PGCE students learn about themselves from two sources; by their assessment of children's learning they find out how well they have achieved their aims, and from the MEd students they get diagnostic information about specific aspects of their teaching and the way in which it has or has not related to the theoretical notions previously discussed.

The MEd student gets some indication of his success as a counsellor through his assessment of the PGCE student's learning from his tutor and peers. In addition, he gets diagnostic information about specific aspects of his counselling and how it relates to principles of learning as applied to both counselling and teaching. Peer appraisal takes place in a group when MEd students scrutinize each other's performance as counsellors. A videotape recording of the student–teacher's lessons and the counselling session with the MEd counsellor afterwards makes this appraisal possible. These recordings provide a variety of examples of different styles of teaching and counselling but all have the same essential focus – how to enhance learning. Thus, although the student teachers teach different subjects, they all attempt to practise teaching skills related to theoretical principles. In the counselling sessions the MEd students attempt to put into practice some of the ideas about learning that the student teachers are concerned with in a counselling session. Each MEd student meets a PGCE student face-to-face. This meeting has its own particular characteristics, ones that demand somewhat different qualities from those demanded by group teaching, and these qualities provide a distinctive focus when the MEd students discuss and evaluate the recordings of their counselling sessions. However, we believe it very important to bear in mind the notion of the counselling session as a learning experience for both types of student.

The recordings of teaching and counselling are not just a useful collection of exhibits but the raw material of 'protocols'. (A protocol is some form of representation or analogue of a lesson. It might take the form of a video-recording of a piece of teaching, an audio-recording or transcript of classroom discourse, or possibly an episode of actual teaching. This material is critically examined by the students, who try to bring to bear their knowledge of theoretical principles to see to what extent they are being implemented, and to assess their relevance to the teacher's purposes. As a result, the student acquires a better grasp of the theory and, at the same time, gains insight into the way practice might be improved.) The array of recordings of teaching and counselling gives considerable scope for this kind of work. The rationale is that by a process of appraising a variety of different examples, students will gain a deeper understanding of the general problems of teaching and learning.

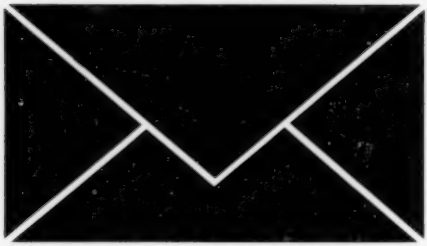
Symbiotic relationship

The collaboration of MEd and PGCE students is, to take an analogy from biology, symbiotic rather than parasitic. The MEd students are experienced teachers who might well find themselves with PGCE students in their schools on teaching practice or, shortly afterwards, as members of staff in their induction period, so the relationship is not forced or artificial. Both students derive a deeper insight into the problems and possibilities of teaching and some idea of relevant learning theory.

The counselling and teaching sessions are miniature experiments where theory is put to its most stringent test. Both types of student are trying the theory to see if it does what it is alleged to do. They tackle the teaching with certain hypotheses based on their theoretical studies

and try them in practice. Thus, they try out the principles in teaching experiments and draw their conclusions from the outcomes of these experiments. They will establish whether the results of their practice uphold their hypotheses, whether they indicate that they should drop them altogether, or whether they should modify them and try again. This process enables the students to make links between theory and practice while they are actually studying the theoretical principles, and not in some mysterious way in their own heads and at a later date.

The MEd option is particularly interesting to anyone involved in teacher education, especially to those concerned with advising student teachers or probationers, and many course members have come from colleges. However, many of its alumni have gone back into schools acknowledging the benefit of this close scrutiny of counselling. With much greater attention being paid to induction, an increasing number of practising teachers are going to be acting as counsellors. This kind of work is clearly close to the hearts of teacher–tutors involved in induction. It may well be that the involvement of this group of people would provide an interesting and useful growth point for this type of activity.



Letters

184 Broomfield Road
Chelmsford
Essex
CM1 4HF

Dear Sir,
Perhaps professional librarians in schools are long overdue. Many are the students whom I have introduced to the library of the Anglian Regional Management Centre and who say: 'Why did no one show me how to use a library when I was at school?' Why indeed? Can Don Rogers (*Trends* Winter, 1977) answer that?
Yours truly,
(Mrs) Felicity Sturt FLA

INTERNATIONAL EDUCATION

Overseas Teacher Exchange

'The Secretary of State hopes that authorities will do all that is possible to welcome exchange teachers from overseas and to ensure that opportunity will be given to the teachers to see something of the educational system other than the school in which they are serving.' This is one of the basic general messages conveyed in an Administrative Memorandum entitled 'Exchange and Interchange of Teachers and Assistants with Overseas Countries, 1979–80' issued jointly by the DES and the Welsh Office earlier this year.

The object of the exchange scheme, introduced in 1972, is to enable teachers to keep in touch with changes in the conditions and life style of the country concerned, as well as refreshing their knowledge of its language. The exchanges, which vary in length from one week to a full academic year, prove valuable not only to the teacher involved, but also to the host school, which has the benefit of a native speaker on its modern languages staff. The Administrative Memorandum, which has been sent to local education authorities, governing bodies of direct grant grammar schools, further and higher education establishments and colleges of education in England and Wales, underlines the importance of the scheme and expresses the hope it will be extended.

European exchange scheme

The European exchange scheme is intended primarily for those teaching French or German, but post-to-post exchanges can be arranged with Spain and Austria, and, to a limited extent, with the USSR.

In addition to their salary, teachers receive a grant from central government to help offset the additional cost of living abroad; they are provided with a basic pack of teaching materials and are able to pay a preliminary visit to the exchange school. Most post-to-post exchanges are for a term or a full academic year, but for those – such as heads of schools, departments or institutes – who find it difficult to leave their posts for as long as a term, there are one-, two- or four-week, grant-aided, intensive study visits to France and Germany.

A number of unilateral appointments in Austria, Germany and Denmark are also available. (Applications by individual teachers and authorities for exchanges with other European countries will be considered.) These are for a full academic year only, and are open to those interested in teaching English as a foreign language. For posts in Germany and Austria a fluent knowledge of German is essential and applicants must have had at least three years' teaching experience at secondary level.

Foreign students from Europe, appointed to schools in the United Kingdom on a unilateral basis, will be responsible for class teaching of their own language and literature for not more than sixteen hours a week.

Exchanges with the United States of America and Commonwealth countries

Post-to-post exchanges with teachers and lecturers from the United States of America and the Commonwealth are available for one year for British teachers and lecturers in nursery, primary and secondary schools, establishments of further and higher education, polytechnics and colleges of education. United Kingdom teachers are seconded on full salary and receive a grant to cover the cost of living abroad, as well as travel costs. Candidates for Commonwealth exchanges should normally be aged between 25 and 45, and have not less than five years' teaching experience.

Assistants

The assistant scheme comprises both the employment of foreign language assistants in British schools and the sending of British students and young teachers to serve in schools abroad. The employment of foreign language assistants in Britain not only gives schools and colleges the advantages of a native speaker of the language concerned, but also effectively creates opportunities for British young people to spend the appropriate period abroad necessary for the completion of their language qualifications.

Posts for English language assistants, who may be students at universities, polytechnics or colleges of education, graduates or serving teachers under the age of 30, are available in

a number of countries and provisionally further afield too. Applicants should have an adequate knowledge of the language of the country in which they wish to serve and should preferably be specialists in that language.

British schools, in turn, may also make applications for foreign language assistants from a wide variety of countries to assist with the oral teaching of modern languages. The Administrative Memorandum sets out the conditions of service for these assistants and suggests that British Schools and colleges help their assistants to find accommodation and encourage them to take part in out-of-class activities and background or induction courses organized by the local education authorities.

Ann Hodgson

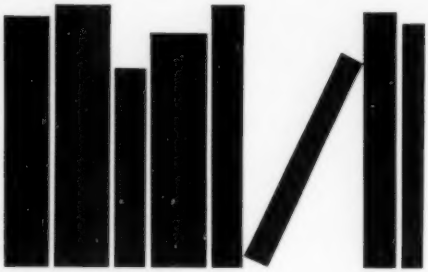
Basic education statistics

Public Sector in England and Wales and Universities in Great Britain

		1966–67[1]	1974–75[1]	1975–76[1]	1976–77[1]
Schools					
Nursery:	Number of schools	464	612	631	648
	Number of pupils (thousands)	29	48	50	52
Primary[2]:	Number of schools	22,831	22,280	23,353	23,364
	Number of pupils under 5 (thousands)	211	400	438	425
	Number of pupils aged 5 and over (thousands)	4,298	4,794	4,727	4,660
	Pupil/teacher ratio[3]	27·9	24·2	23·9	23·8
Secondary[4]:	Number of schools	5,729	5,035	4,982	4,988
	Number of pupils (thousands)	2,833	3,827	3,936	4,039
	Percentage in comprehensives[4]	14·4	69·7	75·6	79·9
	Pupil/teacher ratio[3]	18·2	17·2	17·0	17·0
Special:	Number of schools	797	1,489	1,505	1,541
	Number of pupils (thousands)	69	123	125	127
School leavers:	Percentage with				
	No GCE or CSE attempts	49·0*	18·0	15·6	14·2
	5 or more higher grade O-level/CSEs[5], but no A-levels	8·0	9·0	9·0	9·2
	2 or more A-levels	11·8	12·2	12·7	12·4
Teachers	Full-time in maintained nursery, primary and secondary schools	295,948	419,999	432,014	436,296P
	Full-time in further education colleges[6]	46,161	70,147	72,595	73,091P
Major establishments of further education[7] –total enrolments (thousands)		1,801·3	1,949·8	2,031·1	1,922·0
of which					
Full-time and sandwich		286·8	437·8	486·2	501·2
Part-time day		711·9	726·9	743·3	702·6
Evening only		802·5	785·1	801·6	718·2
Percentage of full-time and sandwich students in polytechnics		..	18·9	20·1	22·7
University students in Great Britain (thousands)[8]		184·2	250·6	261·3	271·8
Open University students in United Kingdom (thousands)[9]		.	53·8	56·0	61·2
Participation in full-time education[10] (as a percentage of age group)					
2–4 school[11]		11·0	21·8	24·7	25·7
16–18 school and further education college[12]		22·9	35·6	36·1	37·8
19–20 further education colleges[12]		4·2	8·2	8·1	8·8
universities		4·5	6·5	6·6	6·7
Expenditure[14]					
Total: at constant (1977 survey) prices[15] £million		4,540	6,605	6,706	6,746P
as percentage of Gross National Product[16]		4·7	6·3	6·4	6·2

[1] Academic year. [2] Including middle deemed primary schools and immigrant centres. [3] Ratios take account of the full-time equivalent of part-time teachers and count each part-time pupil as 0·5. For 1974–75 *et seq* only qualified teachers are included. [4] Including middle deemed secondary schools. [5] O-level grades A–C and CSE grade 1. [6] Maintained and assisted colleges only (including former colleges of education). [7] Maintained assisted and grant-aided. [8] Full-time students only. [9] Undergraduate, postgraduate and post-experience. [10] In maintained, direct grant and independent establishments. [11] Each part-time pupil counted as one. [12] Including teacher training colleges and universities. [13] Including teacher training colleges. [14] Financial years data. [15] England and Wales. [16] United Kingdom public expenditure on education (including school meals and milk) as a percentage of GNP at market prices. P Provisional. * Estimated.

Detailed statistics of education (in seven annual volumes) are on sale at HMSO bookshops. Summary statistics (facts cards) relating to each of the seven volumes are available free on request from the DES Statistics Branch (Telephone 01–928 9222 ext 2776).



Book Reviews

Special education in Scotland

W. B. Dockrell, W. R. Dunn and A. Milne (editors)

Scottish Council for Research in Education £2·50 paperback

Scotland has always made a unique and interesting contribution to special education. This book is a useful source of information about recent developments and current trends at a time when, with the publication of the Warnock Committee report, the education of children with special needs is receiving particular attention. It discusses issues of general interest in the United Kingdom and of particular significance in Scotland.

The editors have collected a series of papers that describes the history of special education in Scotland since 1950, and the scope and scale of present provision, and a review of research and of the development of special teacher training. The contribution of school medical and psychological services, the importance of parental involvement and the special problems of maladjusted children are also discussed. There is too a taste of current practice in two papers that describe the work of a special school and a special unit. More contributions of this kind would have been welcome to illustrate the quality of present provision. Finally there is a look to the future that identifies trends and suggests initiatives.

Each paper is commendably concise and to the point, and together they represent a very wide-ranging and useful review that brings the reader up to date with special education in Scotland. It will be a welcome addition to the growing literature on comparative special education.

J. R. Fish

Extending economies within the curriculum

Keith Robinson and Robert Wilson (editors)

Routledge and Kegan Paul £3·75 paperback

The subject matter of economics and business studies is, in large part, already found in the curriculum of primary schools and the early stages of secondary schools. Pupils may deal in arithmetic, general studies and English, with earning and spending, and with the work, occupations, and daily transactions of people and families; and, in subjects like geography and history, with a variety of micro- and macro-economic topics, such as trade and transport, the growth and decline of industries and the growth of national income and wealth. In the circumstances, therefore, it may seem strange for economics teachers to spend a great deal of effort holding conferences and producing papers about the extension of economics in the curriculum. From the economist's viewpoint, however, the problem is that the various topics mentioned above are not treated in the curriculum as a systematic study, and so cannot be given a thorough and consistent form or developed as a discipline.

The case for the extension of economic study in the school curriculum is sufficiently powerful and self evident for it not to need comprehensive argument. Most of the papers in the present collection (an account of an Economics Association seminar held in Worcester in 1975) are concerned with the practical issues of finding a form and a place in the curriculum for economic and business studies, and with some of the experimental and developmental schemes for teaching and examining them – either on their own or in association with other disciplines or studies. This is very much what might be expected in an Economics Association seminar, since most of those present would already be well persuaded of the merits of the case; but producing a set of papers as disparate as these, in terms of topic and level of argument and educational insight, does not necessarily provide the most convincing approach to the non-economist curricular decision-maker. The linking narrative provided by the editors, and the informative, but backward-looking introduction, regrettably do little to produce a sense of coherence in the presentation. Perhaps a change of objective here would have been more beneficial to the readership, or the potential readership of the book. One gains the impression that the main readership perceived by the editors was the conference membership itself.

While economics in schools is mainly taught as a kind of preparatory A-level with higher education in mind, most of the con-

tributors were concerned with establishing the study as a systematic element in a curriculum in a high degree of change. There is the usual lack of consensus on whether and how to make a distinction between economics and business or commercial studies. This appears to have produced some lack of agreement about the functions of economics in relation to the curriculum of less able and younger secondary pupils.

A marked common feature of the papers and the wider discussion was their concentration on the conceptual bases of economics understanding, and on skills of analysis and thinking to be instilled in school pupils. Perhaps it is time for some stress to be laid on institutions and knowledge about them. The behaviour of economic and business institutions is not entirely rational, any more than that of other institutions, and the impact of this behaviour is of considerable importance to the fortunes of us all. Some introductory treatment should be feasible in the school context if economists mean their study to be realistic and relevant.

P. C. WEBB

Open learning systems for mature students

T. Charles Davies

Council for Educational Technology £2·50 paperback

Open and distant learning; independent, autonomous and directed private study: this is the terminology of the Open University era. The undoubted achievements of the OU itself seem to offer great possibilities for other levels of post-compulsory education. The Russell Report on Adult Education suggested as a way forward 'modest analogues of the OU . . . multi-media systems combining teaching at a distance with face to face tuition'. There could be a buoyant demand from a wide range of students anxious to acquire qualifications through the many vocational courses offered by further education, if only the timing and the locations suited their needs and circumstances. In 1977 the CET commissioned Charles Davies to undertake a small scale survey (six months, part-time) of developments in open learning in colleges and to see what the implications were for the future.

The result is this handbook offering a useful sketch map of the jungle. It contains a definition of open learning (by John Coffey) and reports on those courses established or planned by further education colleges for mature students. The courses investigated are 'open' by nature of their access and availability rather than their abandonment of entry requirements and examinations. In some senses, developments outlined are fairly depressing: the number of courses is small and they are often 'ad hoc', they lack coordination, have been developed largely by individual institutions and have limited transferability. However, the Report offers from current experience seven case studies of successful practice, ranging from O- and A-level courses to professional examinations in quarrying and business management. There are clearly a number of areas in which self-instructional materials could play an important role in the future. BEC and TEC, as well as a number of specialized professional and industrial training agencies, have recognized their potential – at least for part of their courses.

Major constraints emerge as a lack of research (though an appendix by Professor Entwistle of Lancaster University on the psychological aspects of learning at a distance offers valuable guidance); ignorance of the number and type of potential students; the need for in-service training of teachers in course design and implementation; and the lack of any coordinating agency to inform and advise on the quality and appropriateness of this form of learning. The arguments for CET's role as a coordinator and for feasibility studies are rehearsed and make interesting comparison with those of other reports, notably the OU's Venables Committee. All in all, this small-scale study offers a useful, if limited, contribution to the debate on what the Russell Report saw as an 'organizational framework' for distant study.

B. A. CHAPLIN

The needs of the under-fives

National Union of Teachers £0·40 paperback

Co-operation in pre-school education

Joyce S. Watt

Social Science Research Council £1·50 paperback

It is unfortunate that a document bearing the title *The Needs of the Under-fives* should fail to appreciate that those very needs will differ from child to child, from family to family and from community to community. No one form of provision will be right for all children. An over-emphasis on state provision and an under-valuing of other provision can only militate against the increasing need for the

coordination of services for children under five.

The writers accept the need to consider the child as a whole, but pay scant attention to the crucial mother/child relationship, and do little to promote active parental involvement within the schools. They applaud the efforts of other agencies such as health and welfare services in their attempts at parental education, and accept that the teacher has a contribution to make in this, but see the parents' role in school as 'adult help' whose 'lack of professional expertise' . . . 'can sometimes cause more problems than are solved'. There is already good evidence of nursery teachers encouraging parental participation, and of them using their professional expertise to support other forms of pre-school provision.

The need for this kind of collaboration is stated in the SSRC report on 'Co-operation in Pre-School Education', although the author indicates that much more than the sharing of professional expertise is needed if there is to be a closer coordination of services for the under-fives. This well-written report of a study carried out in the Fife region of Scotland examines the different types of provision available, and the contribution each can make to an integrated pattern of pre-school education. The findings make interesting reading, and the author's 'possible framework for the future', while appearing idealistic, does point the way in which a start might be made towards a more coordinated system. The basic prerequisite is, in the author's opinion, that all those concerned with pre-school provision ought to be responsible to the same national and local departments – a view shared by many.

BRENDA STANILAND

Mixed-ability teaching in mathematics

Schools Council

Evans/Methuen Educational £2·50 paperback

Although many schools have now adopted a mixed ability organization – particularly in the first year – detailed information about possible teaching procedures has been hard to acquire, with doubtful consequences in some cases. The Mathematics Committee of the Schools Council felt that the situation demanded urgent action on their part, so they mounted a one-year survey, covering 26 schools, which was undertaken by a group of their members, together with others specially coopted. Their report deserves the attention of all mathematics teachers, since it has much of value to say about the conditions of learning mathematics – whether in all-ability classes or otherwise.

Naturally, in a publication as eagerly awaited as this one, there is the temptation to expect that an answer can be found to every problem. For example, it would have been helpful to have had more detail on how to meet the needs of the least able, assessment, the role of language, pupil cooperation and the pace of working. More guidance may be necessary on such matters as the balance of practical and written work, the visual quality of worksheets and their effectiveness as a medium of learning, the organization and accessibility of resources, and how the teacher can most profitably use the time available to him in the classroom. No doubt the audio-visual pack, which has been prepared to assist with in-service training, will clarify these and other matters which the written document has had to omit in order to remain readable and concise. This report, especially the three case studies, will provide a valuable framework for departmental discussion as well as a useful source-book for planning suitable provision for pupils.

E. L. SEWELL

Assessment for transition: a study of new procedures

R. Sumner and K. Bradley

NFER £2·85 paperback

When children move from one stage of schooling to the next, be it from primary to secondary, or first school to middle school to upper school, there is considerable discussion about the information related to each child. What information is obtained? How is the information gathered? What records are transferred with each child? How are pupils allocated to teaching groups in their new school?

Assessment for Transition is an account of the development of new testing procedures investigated by the NFER in partnership with the Outer London Borough of Hillingdon. The report begins with a useful brief review of relevant research and current discussions on such matters as the passing of information about individual pupils from one school to another. The research itself has been concerned with the development of assessments in mathematics and language by 'creating a bank of assessment exercises, relating to different curricula, from which the primary

schools would select those which fitted in with the work pupils had already done'.

Teacher comment on the exercise suggests that the work represents a promising start on a new approach to the problems of transition. The report concludes by expressing the view that obtaining and passing on information about each child's attainment before transfer occurs has been shown to be acceptable both in principle and in practice. In addition, 'the ways in which the profile information is used by the secondary schools and the amount of assurance the primary schools receive that the effects are beneficial will be critical factors in deciding whether the scheme, or a version of it, becomes established'. At a time when many LEAs are reviewing their procedures for record keeping and for liaison between schools, this report is a useful discussion document, and the procedures developed may well prove useful in the context of the work of the APU and the growth of monitoring at LEA and school level.

COLIN SELBY

Investigations of microteaching
Donald McIntyre, Gordon Macleod and Rory Griffiths (editors)
Croom Helm £8·95 paperback
Microteaching in higher education: research, development and practice
Elizabeth Perrott
Society for Research into Higher Education £2·80 paperback (members) £3·75 paperback (non-members)

These books provide some illumination of the ways in which micro-teaching has developed in Britain over the last decade.

Investigations of Microteaching draws together the results of some of the research undertaken at the University of Stirling. The reports encompass a wide field of enquiry, and include surveys of students' reactions to the use of microteaching in their initial training courses and others by subject specialists who have used it for training modern language, history and English teachers. There are also reports comparing students' teaching behaviours in microteaching and in classrooms.

Microteaching in Higher Education: Research, Development and Practice begins with a review of the relevant research literature and then describes the author's early work as Foundation Professor of Education at the University of Stirling. Two chapters are devoted to reporting, with evaluative comment, the DES-funded research into self-instructional, microteaching courses which the author and her team undertook at the University of Lancaster and which is now available as a commercial package.

Both texts are notable for the empirical approaches used. Adequate and relevant data are included without the risk of bemusing those unconversant with statistics. Of particular value are the knowledgeable comments about microteaching which result from the considerable association that the authors of both texts have had with it. Predictions about the different effects that it is likely to achieve, under varying circumstances, are made with conviction; one study is sufficiently honest to give an account of failure, which gives balance to the argument about the infallibility of systems compared with people. The message coming through loud and clear to this reviewer is that, by dint of patience and research, a range of teaching skills which should be in the repertoire of all teachers has now been identified. Their practice now needs to be integrated into initial and in-service training programmes.

P. J. SILVESTER

The early teaching of modern languages
Peter Hoy (editor)
Nuffield Foundation £1·25 paperback

Those who teach a foreign language to young children will find encouragement and renewed inspiration in these pages. Writing of the early days of 'Primary French', Mr Peter Hoy vividly evokes the hope, energy and enthusiasm of that period. From his analysis of LEA reponses to a specially devised questionnaire he finds evidence that, despite a small decline in numbers, there is still substantial early language teaching in 20 per cent of maintained schools covering the 8–11 age-group. He draws attention to the value which many teachers and advisers attach to this work. He cites examples of positive gains and draws attention to possible future developments.

The Nuffield Committee feels it has a duty to counteract the demoralizing effect which it attributes to the Burstall Report*, as interpreted by the media. Unfortunately that intention colours some of the judgements which are made. There is, for example, a

* Burstall, Clare, Monika Jamieson, Susan Cohen and Margaret Hargreaves. *Primary French in the Balance*. NFER, 1974.

tendency to confuse the undoubted benefits of the pilot scheme itself (new methods, new materials, etc) with those to be reaped by, pupils from a more general introduction of a foreign language into the primary curriculum. The latter depend on the quality of the work done, and the Nuffield Committee admits that it had very limited means of assessing quality. Its favourable estimate is based largely on the subjective impressions of others. The report recognizes that 'the known and necessary conditions for success' are far from being met in most areas and, pending 'a national decision on the value which we place on modern language teaching . . .', the Committee is forced to conclusions which do not differ so very greatly from those of Clare Burstall and her team.

By its tone, by its stress on achievement rather than problems, 'The Early Teaching of Modern Lanaguages' will help to temper the more extreme reactions against primary French. It will, however, leave intact some of the doubts of those whose responsibility it is to determine priorities in the allocation of scarce resources.

G. H. SWINDEN

The rules of disorder

Peter Marsh, Elizabeth Rosser and Rom Harre
Routledge and Kegan Paul £4·95 hardback

This book records a fascinating attempt to build up a social psychology of action based on video-recordings of and conversations with young football fans, and on conversations with those who regarded themselves as trouble-makers in school. Those parts of the book concerned with the behaviour of football fans are based on participant observation, and although of course it is always difficult to know how this method of study affects the basic nature of the situation studied, the perceptions recorded are worthy of serious consideration. The authors are convincing in their attempt to reveal 'social order in events . . . traditionally seen as dangerously anarchic', but, of course, this order is hardly that meant by those who seek to secure or maintain law and order!

The conclusions about 'trouble in school' appear to be based on conversations at a youth club with young people from a local council estate who attend the local comprehensive school. The authors tell us that life in other schools is described in another volume of this series, and that in Paul Corrigan's study (forthcoming) 'Doing Nothing' he suggests that trouble in school is more or less the same elsewhere.

The authors admit the risks inherent in their method, which is to undertake a detailed study of a few cases selected as typical, hypothesizing that they are typical. What is termed the ethogenic approach to the understanding of social action 'is that the very same social knowledge and skill is involved in the genesis of action and of accounts', so that by recording and analysing each separately, the authors believe they have two mutually supporting and reciprocally checking ways of discovering the underlying system of social knowledge and belief.' It is not clear that there is any evidence derived from the school that what is said to happen actually happens; it is therefore rather hard to accept the authors' contention that in the long run a match gradually emerges between what is seen to happen and what is said to happen.

There are no doubt some insights into the principles of pupil behaviour (but hardly new insights?) to be derived from the 28 pages devoted to trouble in school, but the somewhat patronizing tone of the book is sometimes hard to accept. For example, in a comment early in the book about a newspaper account of a fight between 'two huge girls', the authors remark that it could equally be read as 'two huge bears', and go on to say – on a somewhat insubstantial basis – 'we daresay the unfortunate teacher, with whose plight we do indeed sympathize, did not have the faintest idea what was afoot', and later, 'order for her did not exist but was something she wanted to impose on the class'.

No understanding of the behaviour of young people can be complete without hearing and studying their accounts of their actions. In the interests of balance and completeness, one hopes that in any subsequent analysis of the perceptions of pupils of their schools, some attempt will be made to take account also of the perceptions of teachers.

Nevertheless the book is worthy of serious study by all who seek to understand the nature of disruptive behaviour among young people. Successful longer-term approaches to these problems may emerge only with changes which enable these young people to regard themselves as valued members of society. In the meantime however it would be useful if the authors would spell out more positively their views on the nature of helpful strategies for the management of hostility and

violence and for the encouragement of these changes.

CHRISTOPHER A. NORMAN

Framework for the curriculum: a study in secondary schooling

Penelope B. Weston

NFER £5·50 paperback

This highly readable book is one of a series arising from the 13–14 curriculum study funded by the Social Sciences Research Council and directed at Birmingham University by Professor P. H. Taylor.

Part 1 consists of a historical survey of how the 'grammar school' and 'modern school' traditions for the 13–14 age group have developed and integrated in recent years to shape the curriculum in most comprehensive schools. The idea that the comprehensive schools were 'quite conservative' in the early days, yet that they have nevertheless 'created an environment which was more conducive to change than that of the grammar or secondary modern school' is well argued. In this section, as in the others, Penelope Weston makes use of many apt and interesting quotations.

The information in part 2 consists largely of a summary of the outline and structure of the third year curriculum in 100 schools surveyed during 1974–1975.

Perhaps the most valuable part of the book for practising head teachers and directors of studies will be part 3, where the thinking behind the formulation of curriculum policy in two of the schools surveyed is given in some detail, set against the background of eighteen of the schools in part 1. Problems which most English secondary schools are struggling with are sharply focused: what kind of ability groupings are needed for different subjects? How can remedial work be organized? Most difficult of all, which children – if any – should drop the study of a first foreign language at this stage, which children should pick up a second foreign language, and has Latin any place at all? No curriculum planner needs to be told that he has to find his own solutions to these problems, but the situations described so skilfully in this book will be thought-provoking to those who read it.

Administrators may find the summary and suggestions in part 4 more useful than school-based planners. Yet its final sentence should be learnt by heart by every head teacher: 'By making more teachers aware of the significance of the "inner framework" of the school, and involving them more fully in working out some of its details a range of expertise may be built up so that this "inner framework", and the curriculum it supports, can be more readily adapted to fit the needs of particular groups of pupils and the changing circumstances of secondary education.'

T. CARROLL

Teaching English: a linguistic approach

John Keen

Methuen £4·95 hardback, £2·40 paperback

This book is only a few lines into its 118 pages when the first of many simple, but significant statements is made: 'People in education tend to take for granted what students know already, and to focus on what they do not know'. John Keen's argument is that this will not do in English; that English teachers ought to exploit the abilities of students and not their disabilities in the use of the rule-systems of language, and that they need a fuller understanding of language to do so. He asks questions about those formalities of writing in school that may have become standardized, artificial and arbitrary: 'A classroom is a room stripped of the furniture of everyday social interaction'.

He asks for a degree of linguistic tolerance which, though much needed, is difficult to maintain, perhaps the more so in recent years. And it is, surely, only in some linguistician's Utopia that no form of language is inferior or superior to another. It is not, however, germane to his suggestions about the teaching of English that this postulate should be accepted. What is important is his determination to find something constructive in students' writing, and, presumably, their talk.

As well as planting mines beneath some educational and linguistic assumptions, the book offers a body of suggestions, supported by examples of students' work. Students' writing needs to have real purposes ('If someone asked me to describe a fairground at night, my first reaction would be "why do you want to know?" '). Students need to be confronted with real linguistic questions (what is a spelling mistake?; what characteristics have swear words?); they need to be led to explore meanings in contexts, to link language functions with social constraints, and to appreciate what is meant by 'being able to create texts that utilize to the best advantage what language has to offer'.

A reviewer may, perhaps, be allowed to counter a possible criticism of this book. A

good deal of Mr Keen's analysis of language might be well beyond the understanding of the older student of 16-plus, still more of the pupil under 16. But teachers must be mediators; they ought to be able to take the book's message about method, without adopting the examples slavishly. Mr Keen will be of no help to the course-book treadmill teacher. The place for his book might be in the in-service training of teachers, or, even more urgently, in their initial training.

It would be particularly regrettable if readers were to reject the book's argument before reading the short final chapter, 'Sources'. It is in this chapter that Mr Keen asks some important questions about 'themes' approaches. If we adopt 'themes' in a multidisciplinary way, 'what is left of the peculiarly *language* perspective?, spelling and punctuation? Language is a vast and complex subject; there must be more to it than that'.

He concludes by reminding readers of the purpose and format of the 'Language in Use' materials, and summarizing his own version of 'a rational study of language'. One reader at least found the scheme on pp. 110–111 a good starting point for discussion with groups of teachers. Others might find it equally helpful.

HAROLD GARDINER

Schools, careers and community: a study of some approaches to careers education in schools

Bill Law and A. G. Watts

Church Information Office £1·60 paperback

Both the practice and the theory of careers education are developing very rapidly, not always *pari passu*; a fresh book which helps to link the two is thus to be warmly welcomed, particularly from authors with such extensive experience in this field. This book is a report of a small-scale research project in two parts; a descriptive analysis of the differing provision of careers education in six schools, and an account of two 'consultations' or colloquies on the conflicts inherent in careers guidance.

The authors are scrupulous in making explicit the theoretical presuppositions that informed their collection and interpretation of the evidence. The most valuable feature of the book is the descriptive matrix they use, which extends the concept of careers education both within the school (e.g. across the whole curriculum) and outside it, to parents, employers and the community. Given the severe limitations (which the authors themselves acknowledge) of evidence collected in two-day visits by two researchers, the analysis provides plenty of shrewd insights, and some noteworthy revelations about the scope of careers education as conceived by the six schools (e.g. the shortage of what the authors term 'transition learning'). The missing dimension of this analytical method – no doubt inevitable in a project of this scale – is the *evaluation* of pupils' learning; but the very fact that pupils' learning is given a prominent place in the discussion is a major step in the right direction.

The description of the two 'consultations' is much more tentative – the attempt to elicit the complex interplay of roles and expectations among those groups with an interest in the processes of careers guidance is somewhat overburdened with theory, and does not carry the same conviction as the previous analysis.

In their chapter of conclusions the authors range considerably beyond the findings from their case studies; they deal more confidently with the 'how' questions which they raise than with the 'why' questions – although the identification of the latter in itself provides some useful starting points for discussion.

Those who are already familiar with the field will find issue after issue illuminated – often unexpectedly – and should at the least be provoked into a salutory re-examination of some basic assumptions. Careers teachers and their trainers will find the book well worth reading. Those who take decisions that affect the practice of careers education (to whom the book is also addressed) may react adversely to the occasional opaqueness of style, and to the outbreaks of what the book engagingly terms 'sociological shorthand'. They should not be deterred, for they ought not to miss some of the implications about the ways in which schools are run, and the beginnings of a positive critique of schools' efficacy in preparing their pupils for the transition to working life.

DAVID SOULSBY

Reconstructing educational psychology

Bill Gillham (editor)

Croom Helm £7·95 hardback, £4·50 paperback

In this stimulating, and, in many ways, timely book Bill Gillham presents contributions by six practising educational psychologists, a Reader in Education and a tutor to an educational psychology training course, as well as his own two chapters. The views of his

contributors are personal and provocative and will not be entirely shared by some of their colleagues in the profession. They have, in common with him, however, a dissatisfaction with working practices which have been hallowed more by time and tradition than by demonstrable effectiveness, and a concern to promote alternatives which might offer a more fruitful use of the educational psychologist's skills.

Several sacred cows are led firmly to the slaughterhouse, notably the reliance on psychometric techniques still endued with mystic powers by a few psychologists, and the application of medical concepts to the understanding of deviant behaviour. In the latter case, Michael Roe presents a most perceptive analysis of the real nature of what we loosely and, on the whole inappropriately, designate as maladjustment, or disturbed behaviour, regarding these terms as 'verbal smudges' which only serve to obscure our understanding of the children to whom they are applied. Emotions, he argues, are not disordered, they are just emotions.

The use, or rather abuse, of ill-defined terms, and the effects of labelling, are themes underlying much of the book. Hargreaves' chapter provides a thought-provoking account of the way in which labels applied to children's behaviour come to be applied to them as persons, and are ultimately invoked as explanations, ignoring the personal and environmental interactions which have combined to produce the behaviour.

The importance of context and situation is emphasized by Burden in his description of a school-based project from which he derives intervention procedures involving a contract between psychologist and school.

Many besides educational psychologists should find something both to nod to and explode at in this book.

G. CRANMER

Beginning teaching in professional partnership

Norman Evans

Hodder and Stoughton £1·95 paperback

Although the framework of this book ggests an emphasis on induction, this is much more a book about experiments in cooperation between initial training institutions and schools and between college tutors and teachers. As such, it has much to offer of importance to the thinking about professional training, and ways in which the preparation of a teacher can begin through the first year of the college course's school experience, and lead through the induction year to the exercise of full professional judgement and responsibility.

The first part of the book contains three case studies of the use of school-based co-ordinators, professional tutors or co-tutors, in playing a full partnership role in the training process. Some fascinating problems are aired – the difficulty of using the school-based tutors' assessments for teaching practice, for example, as in the Culham/Crown Woods scheme; the difficulty of arranging school-based seminars for students placed in small numbers across scattered rural areas; the sensitivity of heads of departments in schools used by the London Institute students, when the co-tutor from one school visited students in their department. Despite the difficulties, however, the efforts proved well worthwhile and all concerned felt that students finished their course with a much more realistic understanding of the processes of teaching, and a much greater confidence in their own professional judgements.

The final section contains three more case studies, this time describing experiments involving college students in a much closer and more sustained fashion with experienced teachers wrestling with specific educational problems. To one who strongly believes some aspects of professional skill must be learned in this way from experienced professionals on the job, this section makes exciting reading.

The book merits reading and noting by all concerned with the professional development of teachers in schools, LEAs and training institutions. Despite minor and irritating errors (why is Ken Millins described as former Divisional Adviser to HM Inspectorate when he was a member of HM Inspectorate?), this is a valuable and highly readable account of important educational experiment.

PAULINE PERRY

Constructive education for adolescents

W. D. Wall

Harrap £11 hardback

Dr Wall has painted a broad canvas of adolescence in this work. The first section of the book is a simplified but readable review of the current state of knowledge about the psychology of adolescence, and the second section looks at the extent to which current educational provision matches our knowledge of adolescent needs.

The educationist reader is punched into awareness from chapter 1 by the argument that 'any culture, school or family or wider society gets the kind of adolescents it deserves to have in terms of its own attitudes, what it offers and what it refuses'. Dr Wall's argument proceeds to the conclusion that our society is offering far too little to young people and that fundamental, even revolutionary (though in the sense of accelerated evolution), changes are necessary.

The model of adolescence on which the argument is based is an extremely attractive one. Dr Wall believes in human beings, in their ability to work together, to make autonomous choices. He believes in the family. The much quoted generation gap – real as it is in some aspects of family life – does not affect the fundamental parent–adolescent closeness. Dr Wall quotes the 1976 National Children's Bureau figure of 12,000 16-year-olds interviewed, of whom 80 per cent reported that they 'got on harmoniously' with their parents, and their parents agreed that this was so.

Dr Wall's aim is education of a sort which gives to all young people 'not merely a high standard of functional literacy and a sound basis in the kind of knowledge and thinking required by a technically advanced society, but a level of judgement and autonomy equal to or surpassing that obtained in the past by the most successful 5 or 10 per cent.' To achieve this, he believes in an extension of intervention far beyond changes in the formal education system, reaching out into the community and family life, involving parents, educators, health and social services in participative local groups geared to counterbalance educational disadvantage at its source. Dr Wall believes that cooperation between government departments at national level is not enough. Cooperation at local and community level is, he argues, the most effective source of change.

The book is disturbing reading, in the best sense of the word. Dr Wall casts doubt on the universal applicability of project and discussion methods, he dismisses comprehensivization as an effective means of providing equality of opportunity, and feels that changes in initial and in-service training of teachers have failed to effect even a superficial change in our schools. All of this, he believes, is because of a reluctance on the part of our society as a whole to face up to the profound ethical and moral issues with which educational change is really concerned, and which, indeed, imply the need for changes that stretch far beyond the 'five hours of school on five days of the week over two-thirds of the year'.

The responsibility of change – for a society educated to full democratic participation and informed management of change – must lie with all the agencies within that society who are concerned with young people, he argues, not least the parents of those young people. Educators must themselves learn to work in the wider framework of their total community.
PAULINE PERRY

The development of thought: equilibration of cognitive structures
Jean Piaget
Blackwell £8·50 hardback
Philosophers throughout the centuries have been noted for the clarity of their writing. Piaget's early training was as a philosopher, and a search for total meaning beyond observation is always present in his writing. Alas, the clarity of the philosopher is not always present. Even in translation, so often Piaget's use of words conceals rather than assists his meaning, and this, his latest work, is even more obscure than some of his earlier writing.

The concept he presents, if I have grasped it correctly, is bold and exciting. It is an attempt to demonstrate and interpret the dialectic of the learning process. It is a dramatic explanation of the restless human intelligence as an attempt to achieve the equilibrium of knowledge, a balance between our internal models of the world and the facts of our experience. The urge to assimilate, he says, is an urge to construct, since not knowing is a tension and non-balance. But equilibrium is never absolute. The process of accommodation within the learner (i.e. the process of adjusting internal constructs to take account of additional facts and experience) merely reveals new tensions, which in their turn can only be resolved by a new assimilation by trial and experiment, and a further search for a higher form of equilibrium.

Our internal constructs, or models of the world, interact with our experience in such a way that they must forever be reshaped at a qualitatively higher level. No sooner has this accommodation of experience taken place, with its temporary equilibrium, than we are again dissatisfied with the applicability of the

model, its balance with the facts of experience, and we must again compensate the disturbance by regulating our model to achieve a new and higher level of balance between it and experience.

A great deal of the book is devoted to the various observed mechanisms of children's efforts to 'compensate for disturbance' in their internal cognitive systems, and the efficacy or otherwise of these attempts.

Perhaps no psychologist has had more influence on twentieth-century education than Piaget. At 81, he cannot be expected to contribute to our thinking for much longer. The effort to read and understand this, his latest and monumental work, is therefore eminently worthwhile for a number of reasons.

PAULINE PERRY

Helping language development: a developmental programme for children with early language handicaps

Jean Cooper, Molly Moodley and Joan Reynell

Edward Arnold £4·50 hardback, £1·75 paperback

This small book (ninety pages) provides a developmental programme for children with early language handicaps. The strength of the programme it outlines is the involvement of parents who could indeed, under the direction of a speech therapist, carry it out at home. The unusual feature of the programme is that it focuses attention on the development of intellectual processes involved in the use of language. The authors give considerable space to describing pre-language development through early concept formation, symbolic understanding and verbal comprehension.

Full assessment of the children's abilities and handicaps is considered essential before the programme is established. This is achieved by a paediatric report and aural, social, psychiatric and psychological assessment. The book suggests that parents use situations that occur in everyday living – for example feeding and dressing – to teach language. The book developed from an investigation at the Wolfson Centre, Institute of Child Health, London, in which opportunities for intensive language learning were provided for a small group of 3- to 5-year-olds. Occasions such as orange juice and biscuit time were found to be more effective for this purpose than playing with large toys or on the climbing frame.

Aspects of this process of language learning are distinguished and three individual cases are described in great detail. The forms used for individual schedules are part of the appendices and a brief description of a 20-minute film which has been made called 'Help in language development' is also included. This book could be useful for teachers and others working with ESN children with language difficulties.

ROSEMARY W. PEACOCKE

Ability grouping – the Banbury enquiry

David Newbold

NFER £4·95 paperback

This is a concise account of a long, detailed and largely statistical progress report on the first phase of the Banbury Grouping Enquiry.

The study examined the social and academic consequences of mixed ability (heterogeneous) and streamed (homogeneous) groupings in the early years of secondary education at Banbury School. The federal structure of four largely independent Halls – all working to a common curriculum – permitted a controlled investigation of the two systems.

Allocation to classes on entry at 11+, choice of friends, academic progress, attitudes to school and teachers' opinions were investigated by standardized and school-originated tests, questionnaires and discussions with pupils and teachers. Although the findings are predominantly statistical, the main text gives a clear account of the procedures and results.

The principal conclusion of the study is that mixed ability grouping leads to social advantages without academic disadvantages. Although low ability children gain most on both counts there is little to suggest that high-ability children are held back.

There are two factors which seem to have a much greater effect on progress than does the type of organization of teaching groups. First, there is a substantial residual effect of the different primary school backgrounds at the end of the first year (but not the second). This finding must raise major questions about the validity of selection for streaming purposes at 11+ transfer. Secondly, the effect of the teacher in the classroom (teacher-class interaction factor) had a much greater influence on pupil progress in both systems. Although teachers of some subjects – notably French and mathematics – have

especial doubts about the long-term effects of non-streaming, the study did not find evidence attributable to grouping differences that supports their worries. However, the author does raise the important issue of the physical and emotional effects of different forms of grouping on teachers.

The second phase of the enquiry is now being undertaken at Banbury and will attempt to answer the questions: do the results of phase 1 indicate differences which survive to year 5? Do the different grouping backgrounds affect crucial educational and vocational decisions made by the students and the effectiveness of the counselling which is intended to guide these decisions?

E. Ruding

Education in England and Wales

H. C. Dent

Hodder and Stoughton £4·95 hardback, £2·25 paperback

Patterns of education in the British Isles

Robert Bell and Nigel Grant

Allen and Unwin £6·95 hardback, £3·50 paperback

Both of these books offer an overview of the organization of education in the British Isles but their approaches differ considerably.

H. C. Dent's book deals with the organization of education in England and Wales. There is an introductory historical survey followed by concise, but detailed chapters on primary and secondary education, the welfare services, the education of the handicapped, independent schools, further education, teacher training and the universities. The addition of clear references, reading lists and a comprehensive index make it an admirable introduction for students and a handy, if necessarily limited, reference book for those who need to refresh their memories of how the system works.

R. Bell and N. Grant take a wider field covering education not only in England and Wales but also in Scotland, Ireland, the Isle of Man and the Channel Isles. Their purpose too is different from that of Professor Dent. Rather than offering a detailed account of the various education systems, they are concerned to explain their similarities and differences in terms of history, culture and politics. In addition, the various legislative, political, economic, and demographic mechanisms which lead to interaction between the systems are analysed and discussed. It is a forcefully written and thought-provoking book which deserves to be widely read. The chapter on the role and future of the 'professionals' in education is particularly rewarding.

Together the two books, the one descriptive, the other discursive, provide complementary views of how education works in the British Isles. Both, however, remain at the level of general theory and practice. How education ultimately works at the individual level is not their province.

D. W. Sylvester

Design and technology in the school curriculum

Tom Dodd

Hodder and Stoughton £1·95 paperback

The arrival of this scholarly treatise is timely. It should be read by all who have any responsibility for the curriculum in secondary schools and by teachers of craft, design and technology. It contains important messages for parents, employers and those responsible for careers guidance.

Tom Dodd helps to put craft, design and technology in perspective. He says something about the origins of the subject and this is shown to be necessary for understanding current dilemmas. What are the essential differences between art and craft, in educational terms? How much value has the 'end product', the artefact?

Particular care may be needed when reading the vocational references. Perhaps, in this context, we should remind ourselves that all popular education had its roots in vocational need. The training elements, however, have always been leavened to a greater or lesser extent – a process which is even more important today than in the past. Craft, design and technology has suffered more, perhaps, from the vocational image than other disciplines, but a breakthrough may now have occurred. The Standing Conference on University Entrance recommends that some of the new examinations in the subject should be given full recognition for the purposes of general entrance requirements.

The author resists any temptation to claim special merits for craft, design and technology but he is right to suggest that there is scope here for serious research. The extensive appendices and bibliography could provide useful resources.

Colin G. White

What people wore: a visual history of dress from ancient times to the twentieth century

Douglas Gorsline

Orbis Books £6·50 hardback

It has been till now very difficult to get hold of an inexpensive yet comprehensive one-volume account, in English, of European and American costume. *What People Wore* certainly fills that gap. It will, of course, be of particular interest to history and art teachers, but it will be of general interest too.

Since we are offered a text and almost 1,800 illustrations for only £6·50, it may seem a little unfair to carp, but the enterprise would undoubtedly have benefited if a few of the illustrations had been in colour. Nevertheless, this is a fascinating account.

One for the school library, perhaps.

ADDITIONAL BOOKS RECEIVED

ANDREWS, IAN. *Pompeii*. Cambridge Introduction to the History of Mankind: topic book. Cambridge University Press, £1·25.

ASSOCIATION OF ASSISTANT MISTRESSES. *The teaching of reading*. Association of Assistant Mistresses, free.

BERESFORD, PETER and PATIENCE TUCKWELL. *Schools for all*. National Association for Mental Health/Campaign for the Mentally Handicapped, £1·10.

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